RAILROAD GAZETTE

FRIDAY, JANUARY 29, 1904.

CONTENTS

Contributions

Wheel-Carrying Rail Joints.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following is an excerpt from an article published in the *Zentralblatt der Bauverwaltung*, of date Dec. 5, 1903:

The *Railroad Gazette* of Nov. 6 gives a description, with accurate drawings, of the Haarmann reinforced joint (with lapped webs and joint supports), which it describes as the rail joint used on the high speed line (for the Zossen high speed tests). The Haarmann arrangement was only used experimentally on a very short distance, 16 rail lengths. The company had no objection to allowing the use of a few wheel-carrying fish plates. It has been shown that these are entirely without influence on the passage of the vehicles, as in ordinary service they were so hammered down as to be entirely untouched by the wheels of the high speed cars.

The above statement simply confirms previous experience that wheel-carrying joints do not solve the joint question so long as they require a widening of the running surface to such an extent that the joints cannot be cleared by the false flanges of worn tires. The drawing which you showed in your issue of November 6 of the Haarmann joint in the high-speed tracks, gives the width of the rail head as 2.83 inches, but the wheel-carrying joint increases this width by 1 in., making a total width at the joint of 3.83 in.; whereas the false flange would begin to form on this width of rail at about 3.3 inches from the true flange of the wheel, so that in course of time all worn wheels with false flanges must strike such a joint.

That the wheel-carrying principle has value, and is the most likely solution of the joint question, is made apparent by the many endeavors to overcome the one weak or objectionable point—the striking of false flanges. The most instructive and authentic publication on this question is a résumé of 20 years of actual test and experiment to solve the joint question, made on the Royal Saxony State Railway, and published in the *Zeitschrift fur Architectur und Ingenieurwesen*, Volume 7, 1897. The result of these tests and trials was the adoption as standard on the Saxony State Railway of the "Auflauflasche" (wheel-carrying angle bar) many years ago. Owing to the favorable results attained in Saxony the Royal Bavarian State Railroad also adopted the Auflauflasche about three years ago as standard.

The years of practical experience in Saxony and Bavaria rob the Berlin statements of all value, other than the statement that wheel-carrying devices to be practicable must be cleared by false flanges.

The maximum permissible limit of widening the running surface of a rail at the joint is best practically determined by inserting the wheel-carrying joint in the ends of rail. I do not wish to be understood as advocating the shaping or cutting of rail ends to suit a wheel-carrying joint. It is merely a suggestion, of about the most simple way of trying the merit and principle of a wheel-carrying device, and to determine the joint question within a reasonable time at a minimum expense.

MAX BARSCHALL.

The Turning Moments of Four-Cylinder Balanced Compound Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In noting the discussion on the above subject between Mr. Coster and Q. E. D., in the *Railroad Gazette* of January 15, I think the point is well taken by the latter, **and I agree with him on the setting of the cranks of the four-cylinder compound locomotive. Even were the** cranks set at 90 degrees to each other, as claimed by Mr. Coster, I cannot see how the turning moments would be any more uniform than with the simple engine; any more than I could (as pointed out in a former article) agree with Messrs. McCarroll and Beardsley, that the turning moment of the "Vauclain" compound was more uniform than that of the simple engine. Mr. Coster refers to his statement as being "absolutely indisputable." Here are two of us that dispute it. To begin with, the cranks of the Baldwin four-cylinder balanced locomotive are not set at 90 degrees to each other, and according to Q. E. D. the cranks of the "De Glehn" are not. Yet I see no reason why they may not be so arranged, and more readily than the Baldwin type. As I understand it, beginning with the right hand side, the crank pin on top quarter is No. 1, the right crank axle being No. 2, which is at 180 degrees from No. 1; the next in order is the left cranked axle No. 3, set at 90 degrees with No. 2, while No. 4, the crank pin in left wheel is at 180 degrees with No. 3. As to the turning moment, we have, say 7,000 pounds pressure on each crank, Nos. 1 and 2, where Nos. 3 and 4 are doing no useful work. Then, allowing Nos. 1 and 2 to be doing 7,000 lbs. each, would not the rotative effort be as uniform if the work of the two was combined on one crank, making 14,000 lbs., acting on the one crank? As to the four-crank triple, there is no comparison with the four-cylinder locomotive, as no builder would think of dividing the 360 degrees by four, to obtain an even rotative effort. To be sure, the torsional stress is probably not as great with this arrangement, as with the simple engine, but to still further eliminate the torsional stress, I would suggest a modification of this arrangement. The crank axle No. 2 (right side) being set at 90 degrees with No. 1, the crank axle No. 3 (left side) set at 90 degrees with No. 2, and the pin No. 4, set at 90 degrees with No. 3. By this arrangement the torsional stress is more evenly divided between both ends of the axle. Of course this arrangement would change the system from the "Woolf" to the receiver system, which is not necessarily an objection to this arrangement, while the balancing effect is still preserved. The original "De Glehn," according to the description of Q. E. D., relieves the torsional stress to some extent in that each pair of drivers is doing a like amount of the work, instead of concentrating all the work on one pair, but the proportionate stress is, of course, the same. And on the whole, I am inclined to think, the original is the most preferable arrangement, as a side rod must be employed in either side, if a 4—4—0 or a 4—4—2 or even a 2—6—2 arrangement of the wheels is desired.

J. V. N. CHENEY.

The Pressure Retaining Valve: Its Value and Importance.

BY F. H. PARKE.

The governor is an insignificant but extremely important part of the steam engine, and the same statement applies to the pressure retaining valve in estimating the relative value of the various devices that constitute the air-brake system. While it can be dispensed with on comparatively level roads, the regulations of the Master Car Builders' Association wisely recognize it as a necessity in hilly or mountainous districts, and since all cars used in interchange are certain to pass over roads of this character from time to time, its proper installation and maintenance are provided for by legislation and its omission can be supplied at the cost of the car owner, or a car, not so equipped, can be refused by the receiving road at any junction point.

Leaving the matter of safety entirely out of consideration, the retaining valve, properly installed and maintained, will accomplish the following results:

First.—Permit a higher average speed in descending grades and decrease the variation of speed due to alternate application and release of the brakes.

Second.—Gives increased cylinder pressure and consequently greater braking power with an equal expenditure of air, which conversely means more reserve for emergencies and notable economy in air consumption.

Third.—Eliminates unequal piston travel, including the heavy shocks incident thereto, loss of power, etc., and insures greater uniformity of work performed by each brake in the train at a time when this is most necessary.

In view of these facts, the neglect of this device, as shown by a recent investigation made at the instance of the Air-Brake Association, is amazing. This investigation developed the following conditions:

1. Seventy-five per cent. of the retaining valves inspected were defective and trains could not be got over the road without great delay if they were held for necessary repairs to this part of the apparatus.

2. Out of 1,500 retaining valves inspected, there were but 137 that would hold pressure.

3. Out of 3,000 cars inspected, there were 26 per cent. of the valves which were useless and all of these defects were located with the eye without the aid of air pressure. Of these, 152 were applied at an angle of 45 deg. to the vertical; 165 had broken pipes; 119 were loose on the end of the car; on 82 cars cylinders and reservoirs being loose, rendered the retaining valves useless on them; 27 valves were missing, of which 12 had never been applied; and 265 had the union loose in the pipe leading to the retaining valve. On 56 others the pipe joints were so numerous as to greatly increase the chance of leaks.

4. Two hundred and fifty new cars were found upon which the union in the pipe leading to the retaining valve was so large that it would slip on the threads and could **not be tightened. All reports showed that the pipe between** the triple valve and the retaining valve is the most poorly maintained part of the apparatus, and the seat of most of the trouble.

While it seems certain that a little thought on the part of railroad officers will awaken their active interest in seeing that the retaining valves, furnished by brake manufacturers as an integral part of all freight brake equipments, and therefore included in the charge, are as carefully installed and maintained as the other brake devices for which they pay, a number of simple but significant curves and diagrams are herewith presented for the purpose of demonstrating the importance of this subject so clearly that no extended argument or discussion is necessary.

Fig. 1 shows approximately the change in speed of a 40,000-lb. car, having a capacity of 100,000 lbs. on a 2 per cent. grade, assuming that the car is slowed down to 5 m.p.h. and the brakes released. The force tending to accelerate the car is 2 per cent. of the total weight of 140,000 lbs., or 2,800 lbs. The total frictional resistance to acceleration may be taken at 8 lbs. to the ton, or 560 lbs. The effective accelerating force is therefore 2,240 lbs. Since accelerating force =

$$\frac{\text{weight}}{\text{gravity}} \times \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

$$\text{Final velocity} = \frac{\text{force} \times \text{gravity} \times \text{time}}{\text{weight}} \text{initial velocity,}$$

and by substituting different values of time in this equation, the final velocity is easily found, corresponding to any lapse of time.

If no pressure retaining valve is used, the accelerating force of 2,240 lbs. above found will cause the car to accelerate approximately as shown by the line marked "no pressure in the brake cylinder," and in one minute's time the speed would increase from 5 to about $26\frac{1}{4}$ m.p.h. With the retaining valve, we will assume that the car has an 8-in. cylinder; that 15 lbs. is retained in the cylinder during the whole time after release; that the car has a total brake leverage of 70 per cent. of its light weight when there is 60 lbs. cylinder pressure, and that 80 per cent. of this is effective at the brake-shoes; and that the average co-efficient of friction between the shoes and the wheels is .25. Then the pressure on the wheels will be $\frac{15}{60} \times .70 \times 40{,}000 \times .80 = 5{,}600$ lbs., which multiplied by .25, the co-efficient of friction, gives 1,400 lbs. retarding force exerted by the brakes. The accelerating force in this case would then be only 840 lbs., and the speed would only increase to about 13 m.p.h. in one minute's time, as shown by the line marked "15 lbs. pressure in the brake cylinder." The increase in speed therefore under such conditions is $21\frac{1}{2}$ m.p.h. without the retaining valve, and 8 m.p.h. with it; or the speed increases $2\frac{2}{3}$ times as much under the conditions which prevail when the valve is absent.

It must be understood that the above assumption of 15 lbs. pressure in the brake cylinder is really a very much less favorable condition than really exists, for after release, the reduction in the cylinder to 15 lbs. through the restricted port of the retaining valve really occupies over half a minute, as already stated, so that the retarding force will really be considerably greater than that here assumed; but for the sake of simplicity, we can make this assumption, since the results are very much on the safe side.

Let us further assume that the length of the grade (Fig. 1) is 15 miles, the maximum allowable speed in descending, 20 m.p.h., and the length of the train such that it takes 45 seconds to recharge the train pipe and auxiliary reservoirs. From the point where the vertical line through 45 seconds cuts the horizontal line through 20 m.p.h., draw lines parallel to each of the full lines described above, and these will show that in order to keep within the speed limit given, such a train without retaining valves would have to be slowed down to a speed of 4 m.p.h. before each release, whereas with retaining valves, the minimum speed need only be 14 m.p.h. Without retainers the average speed would be 12 m.p.h.; with retainers it would be 17 m.p.h., or 41.5 per cent. greater. In the former case, it would take 1 hour and 15 minutes to descend the grade, while in the latter it would take 53 minutes, a saving of 22 minutes. In reality, trains using retaining valves are continually being brought down such grades, with a variation of speed of less than four miles per hour, so that the actual saving in time is still greater than this.

Fig. 2 shows the cylinder pressure resulting from any given train pipe reduction, when retaining valves are in use, and also when not in use, as marked on the diagram. Of course the first application in all cases would cause the pressures to follow the curve marked "without retaining valves." But with the retaining valve handle turned up, each application after the first release would raise the cylinder pressure along the line marked "with retaining valve." In the first case, it will be noted that ½ lb. reduction of train pipe pressure is necessary to raise the pressure in the cylinder clearance space to the point where it will overcome the resistance of the release spring and start the piston outward. Also the reduction necessary to force the piston, against the release spring, to its full 8-in. piston travel, is slightly less than 6 lbs.

After the first release to recharge the auxiliary reservoirs, the pressures obtainable for certain train pipe reductions are very different when retaining valves are used and when they are not. For example, a 5-lb. reduction gives $33\frac{1}{2}$ lbs. with retainers, and no braking power at all without them; an 8-lb. reduction gives 44 lbs. with retainers and 15 lbs. without, etc. **The cylinder and reservoir equalize at 56 lbs., with a 14 lb. reduction**

when using retainers, and at 50 lbs. with a 20 lb. reduction when retainers are not used. If about 30 lbs. in the cylinder is necessary to hold the train, it will require a primary train pipe reduction of nearly 12 lbs. the first time, but only a little over 4 lbs. after the first release, if retaining valves are used; without them it will require a 12 lb. primary reduction after each release.

Fig. 2 shows clearly the great advantage of using retaining valves; the greatly increased pressure for a given train pipe reduction giving from 715 per cent. at 6 lb. reduction to 150 per cent. at 14 lb. reduction more braking power for the same expenditure of air. Also the necessary reduction being so much smaller when retaining valves are used the application is made just that much quicker. The cylinder pressure in emergency application with retainers is about 62 lbs., and without retainers, about 57 lbs., nearly 10 per cent. additional in favor of retainers.

Considering the retaining valve as an air economizer, Fig. 3 represents the amount of free air consumed for different cylinder pressures, with and without retaining valves in use. It is understood that during the first application, the air consumption would follow the line marked "without retaining valves," but for each subsequent application after the first release to recharge the auxiliary

the *second* release to recharge would be $1 + 1 + .69 = 2.69$ cu. ft. without retaining valves, and $1 + .69 + .23 = 1.92$ cu. ft. with retaining valves. The saving would then be $\frac{1.92}{2.69} = 28\frac{1}{2}$ per cent.

After the *third* release, the air consumed at the same cylinder pressure would be 3.69 cu. ft. without retaining valves, and $1.92 \times .69 = 2.61$ cu. ft. with retainers; the saving in this case would be $\frac{2.61}{3.69} = 29.3$ per cent. After the *fourth* release, the saving would be $\frac{3.30}{4.69} = 29.7$ per cent.

Fig. 4 shows curves which indicate the percentage of air saved for any cylinder pressure in an 8-in. cylinder after the first, second, third and fourth releases to recharge the auxiliary reservoirs, when calculated by the above method. The amount saved by the use of retaining valves increases with each release to recharge, and after the fifth release the amount saved is practically 30 per cent. This means that by merely maintaining and using retaining valves on a train having 8-in. brake cylinders, the air consumed by the brakes is 30 per cent. less; the air needed to recharge the train pipe and auxiliaries is 30 per cent. less; that a given main reservoir supply

ing valve, after the weighted valve was lifted, permitted the pressure in the cylinder to reduce too rapidly down to the holding power of the retaining valve before the recharge of the auxiliary reservoirs was completed; the restricting of this port to $^{1}/_{16}$ in. in diameter overcame this difficulty. This is the valve now used with 6-in., 8-in. and 10-in. cylinders, but the advent of the heavy passenger cars and large brake cylinders has brought into use a valve containing a $\frac{1}{8}$-in. instead of a $^{1}/_{16}$ in. vent port, which will handle the larger volume of air in proportionate intervals of time; namely, will reduce the brake cylinder pressure to 15 lbs. in from 30 seconds to 60 seconds, according to the maximum cylinder pressure obtained during the application of the brake.

Modifications of these two types of retaining valves have been made for use in connection with vestibule cars, on which the valve is located outside of the hood and operated from within by an extension handle which comes through into the hood, the relative sizes of the ports remaining unchanged. By this arrangement the noise of the escaping air is avoided without affecting the accessibility of the valve.

Another type of valve recently placed in use is the driver-brake retaining valve which embodies the features of the present valve and, in addition, has also a lap posi-

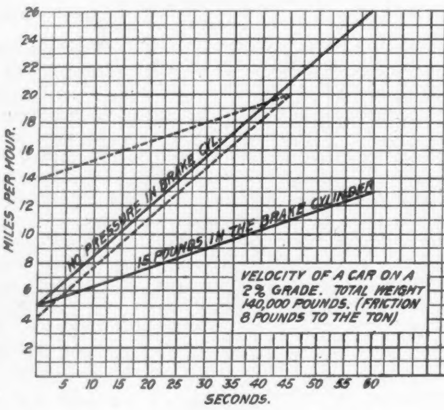


Fig. 1.

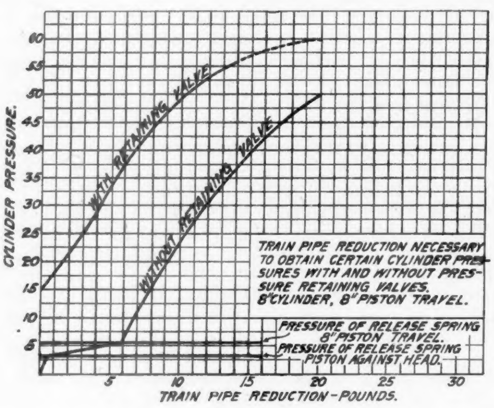


Fig. 2.

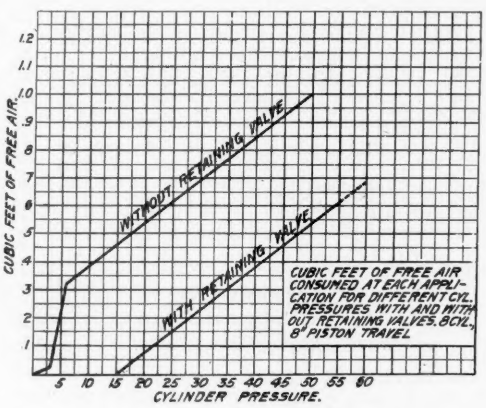


Fig. 3.

reservoirs, whenever retaining valves were used the consumption would follow the line marked "with retaining valves" for each application. The horizontal dimensions indicate cylinder pressures per square inch, and the vertical dimensions cubic feet of free air consumed. Following through the applications as outlined above in connection with Fig. 2, it will be seen from Fig. 3 that during the first application, the quantity of air necessary to fill the cylinder clearance space to a pressure sufficient to overcome the pressure of the release spring and start the piston outward is approximately .023 cu. ft.; the quantity necessary to push the piston and release spring to 8-in. piston travel is about .32 cu. ft.; the quantity necessary to produce 15 lbs. pressure in the cylinder is .46 cu. ft.; to produce 30 lbs. pressure, .69 cu. ft.; the quantity to produce equalization (50 lbs.) is 1 cu. ft. At release the pressure gradually falls to 15 lbs., which is retained. This is equivalent to .46 cu. ft. of free air. Applications thereafter are simply added to this amount, and therefore the curve marked "with retaining valve" shows the quantity of additional air necessary to produce cylinder pressures above the 15 lbs. already present, up to the equalization at 56 lbs.

Consequently if 30 lbs. pressure is necessary to hold the speed of the train under control, the quantity of air to produce the first application will be .69 cu. ft. As the air leaks by the piston, the engineer will again make a reduction to hold the cylinder pressure up to 30 lbs., and he will continue to do this until his train pipe pressure has fallen 20 lbs. (This is the lowest limit recommended for train pipe pressure.) Fig. 2 shows that a 20 lb. reduction is equivalent to 50 lbs. cylinder pressure, consequently it will be seen that no matter what the cylinder pressure may be, if that pressure is held up in the cylinder by continually making reductions till the train pipe pressure falls 20 lbs., the amount of air consumed is exactly the same as if there had been one reduction of 20 lbs., or 50 lbs. cylinder pressure, which from Fig. 3 gives an air consumption of 1 cu. ft.

After the first release to recharge, the quantity of air necessary to again raise the cylinder pressure to 30 lbs. will be .69 cu. ft. without retaining valves, and .23 cu. ft. with retaining valves. The total amount of air used up to that time would be 1.69 cu. ft. without retainers and 1.23 cu. ft. with them. The percentage saved by retaining valves would then be $\frac{1.23}{1.69} = 27$ per cent., when the cylinder pressure was 30 lbs. in an 8-in. cylinder and there had been one release to recharge. As the pressure in the cylinder again leaked down, and successive applications were made to hold it up, until the train pipe pressure again fell 20 lbs., the consumption of air would be again 1 cu. ft. in cases where the retaining valves were not used; but if the valves were in operation, the equivalent cylinder pressure under these circumstances corresponding to a 20 lb. reduction is indicated by the dotted continuation of the curve in Fig. 2 marked "with retaining valve" to be about 60 lbs. In Fig. 3, the line similarly marked, shows that the air consumption involved in raising the cylinder pressure from 15 lbs. to 60 lbs. is .69 cu. ft. of free air. Consequently the total amount of air consumed in bringing the cylinder pressure to 30 lbs. after

on the engine is good for 43 per cent. longer time; that the work of the pump is reduced 30 per cent. during the time of descending the grade, when it is generally the heaviest; and the length of time between releases to recharge is much greater. It is easily seen that on cars having brake cylinders 10 in. or more in diameter that the amount of air saved would be considerably greater than that just given, and all the other benefits are greater in the same proportion.

In conclusion, it may be interesting to note the development of the retaining valve, with some reference to the various forms in which it is now supplied. The necessity of recharging the auxiliary reservoirs on long grades and the difficulty of accomplishing this without allowing the train to get beyond control, made it necessary in the early days of air-braking for roads in mountainous districts to stop freight trains at the summit of heavy grades and place all triple valves in the straight air position, the plain triple valves of that period being so arranged that they could be connected in or out for either automatic or straight air service. To overcome this undesirable necessity and ascertain what was required to permit trains of that time to be safely controlled on heavy grades with the automatic brake a series of tests were made in 1882 which showed that on a 220-ft. grade, 20 miles long, the light capacity cars of that day required an average cylinder pressure of from 6 lbs. to 20 lbs. As a result the first retaining valve, of the diaphragm and spring type, was devised, and its capacity was fixed at 10 lbs.

When, in 1886, the first quick-action air-brake equipments were installed on passenger cars, the schedule speed of passenger trains was such that the capacity of the 10-lb. retaining valve was found to be insufficient to hold the train within the desired limits of speed. By increasing the capacity of the valve to 15 lbs., the desired result was produced, and, owing to the increased weight and carrying capacity of freight cars then building, this valve was also applied to them.

Because of its unreliability, due to corrosion, the diaphragm and spring type of valve was superseded by a weighted valve of the type now in use, but in 1891 this valve was found to have insufficient capacity to control 30 loaded cars of modern heavy design down a 220-ft. grade. The $\frac{1}{4}$-in. hole through which the air from the brake cylinder escaped to the atmosphere from the retain-

tion. With the handle pointing down no air is retained in the brake cylinder when the triple valve is in release position; when pointing straight out from the valve, 15 lbs. is retained; and when pointing up, all pressure is retained in the brake cylinder. The object of this valve on the engine, aside from its usual advantages, is to permit the engineer to keep the driver brake applied while the brakes on the train are being released, thus keeping the slack bunched and avoiding the tendency for it to run out and break the train in two when a release is made at low speeds.

The foregoing brief description of the introduction and development of the pressure retaining valve indicates that it was born of necessity, and developed to meet the actual requirements of practice. As an essential part of the air-brake equipment, it has grown in importance continually and should be considered and treated as carefully as any other part of the brake equipment. The roads in the Rocky Mountains realize this and stop their trains at the top of their heavy grades to inspect the brakes and make a pressure retaining valve test. This practice is most desirable. On all grades where it is necessary to keep the brakes applied continually to prevent the train from getting beyond control, the use of the retaining valve is an absolute necessity, and before starting down a heavy grade, if proper precautions are not taken and the retaining valves do not hold, a runaway is likely to result.

On a grade where it is necessary to hold the brakes applied all the way down, all the retaining valves should be used, for the reason that if only a part of them are used—say on the head end of the train—those cars which have the retaining valve in use are compelled to do much the most work. For, when the second application occurs, those cylinders where retaining valves are in use are already filled with air at 15 lbs. pressure, while the rest are not, so that a much greater braking power will result on those cars with retainers, which is liable to produce hot wheels. The consumption of air is less when all the retaining valves are used, and the necessary braking power is distributed evenly throughout the whole train, thereby making it less for each car.

Inasmuch as the pressure retaining valve is always purchased and generally installed, and the benefits outlined above depend simply on the proper maintenance of it, it is manifest that the great increase in economy and

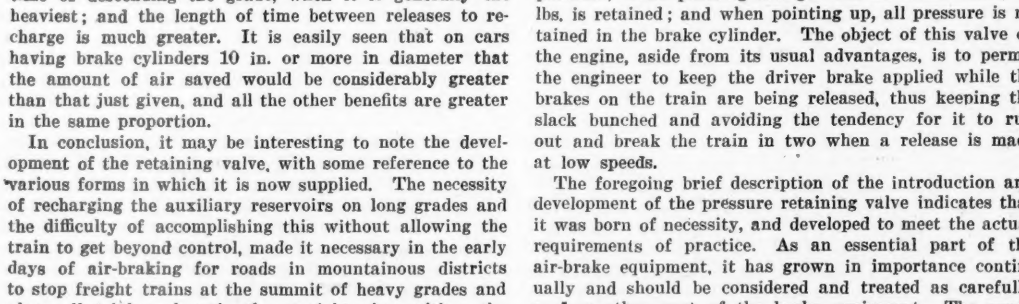
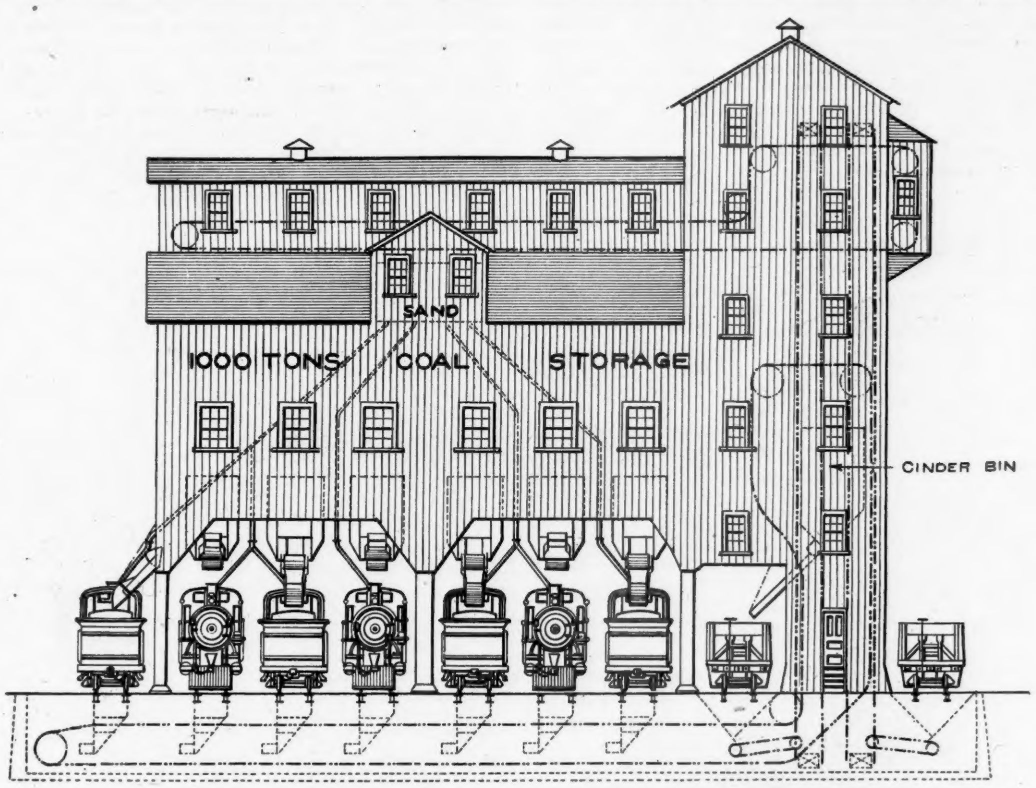


Fig. 4.

safety by their use abundantly warrants keeping the retaining valve connections in as good condition as the rest of the apparatus; they should be given equally good inspection, and held to the same rigid tests as are used with the remaining air-brake equipment.

Locomotive Coaling Station of the St. Louis Terminal Association.

In the description of the St. Louis terminal improvements in the *Railroad Gazette*, March 20, 1903, mention was made of the intention to build a large coaling station to clean, coal, water and sand a large number of locomotives at one time. The station is now under construction by the Link-Belt Machinery Company, Chicago. It will have a storage capacity of 1,000 tons and is so arranged that seven locomotives can take coal, sand, water and discharge cinders at one time, and 21 locomotives may be cleaned simultaneously. The number of locomotives to be handled each day is about 400.

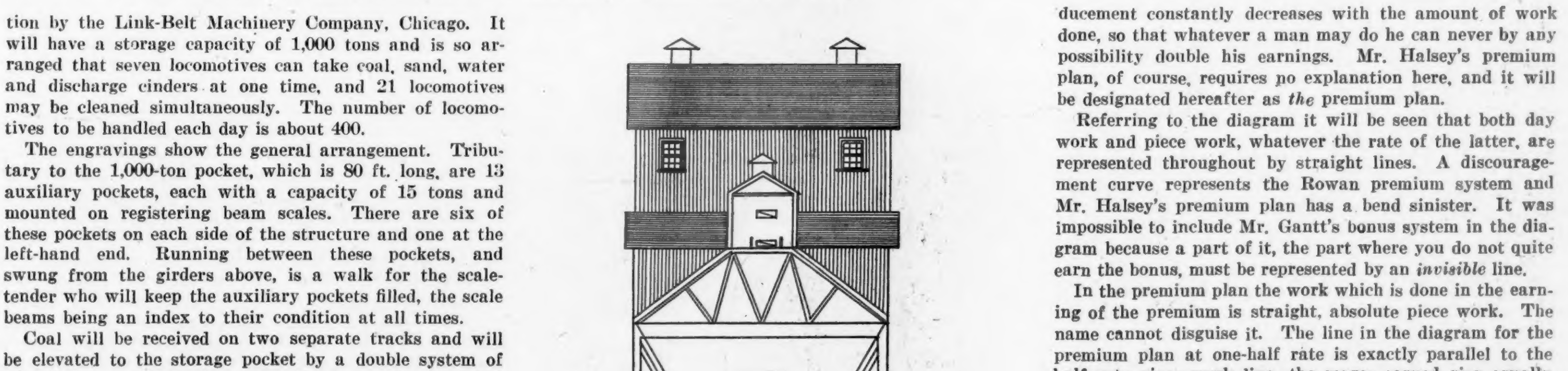


Side Elevation of Coaling Station for Terminal R. R. Association, St. Louis.

The engravings show the general arrangement. Tributary to the 1,000-ton pocket, which is 80 ft. long, are 13 auxiliary pockets, each with a capacity of 15 tons and mounted on registering beam scales. There are six of these pockets on each side of the structure and one at the left-hand end. Running between these pockets, and swung from the girders above, is a walk for the scale-tender who will keep the auxiliary pockets filled, the scale beams being an index to their condition at all times.

Coal will be received on two separate tracks and will be elevated to the storage pocket by a double system of Link-Belt carriers having a combined capacity of 2,000 tons in 10 hours. The arrangement is such that either system may be put out of commission without interfering with the other. The loaded coal cars are drawn over the track hoppers and the empty cars removed by a double car-puller, shown in the plan. It is electrically driven and has a capacity of eight loaded cars.

As seen from the cross-section, each cinder pit will accommodate three locomotives. Where there are a number of locomotives on one track awaiting the service of the station, the first one can take coal, sand and water simultaneously, requiring about four minutes if a full tank of water is needed. It can then move up to be cleaned, a second locomotive take its place under the station and a third move up onto the pit, enabling all three to be cleaned at one time. The station will serve engines headed either way. An independent carrier will receive the cinders from the track pits and deposit them in an overhead bin which will discharge into a car on one of the coal tracks.



Cross-Section of Coaling Station for Terminal R. R. Association of St. Louis

In this same track is a hopper for green sand, which is elevated by carrier to two overhead circular steel tanks having a capacity of 125 cu. yds. each. Each tank discharges into a dryer immediately beneath, the pipe from which passes up through the center of the tank and assists in drying the adjacent sand. From the dryers the sand is again raised by carrier to the top of the structure and discharged by gravity into two storage bins of 85,000 lbs. capacity each, one being on each side of the station, midway of the tracks. The gravel and other refuse from the sand is discharged into the cinder bin. Water will be delivered to the locomotives from two cylindrical tanks above the scale pockets, holding 20,000 gals. each. These tanks will be connected to the city mains.

The most notable thing about this station is the material of construction, which is steel, above the foundations. This is the first instance in which the Link-Belt Machinery Company has used steel, timber having been used in previous structures. Although somewhat more expensive in first cost the combination of strength and lightness, the greater durability, the immunity from fire and the more pleasing appearance easily justify the additional expense. The covering is to be corrugated galvanized iron. Electricity will be used throughout for motive power.

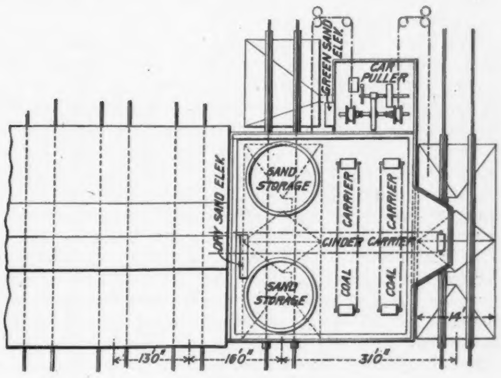
There is to be an international transportation exhibition in Milan in 1905, which naturally must be confined chiefly to railroad appliances, as there is no navigable water there except canals. A very large piece of ground has been secured for it, on which it is intended to construct a regular railroad yard, where everything may be shown in place.

Piece Work and Bonus Systems.

At the meeting of the American Society of Mechanical Engineers last December, Mr. Frank Richards presented a paper on "Is Anything the Matter With Piece Work?" Extracts from several discussions of this paper have already been published in these columns. Below is a liberal extract from the original paper:

The purpose of the accompanying diagram is to show the actual earnings of the workman, and of course also the labor-cost to the employer, for any given amount of work done under either day work or piece work at different rates, the Rowan premium system and Mr. Halsey's premium plan. The amount of work done is represented by the lengths of the horizontal lines and the wages paid are represented by the vertical lines.

As the Rowan system is not in use in this country all may not understand its basis of computation. It starts with a fair day's work, although that may not be the term used to designate it. The unit assumed is the amount or quantity of work which the man should ordinarily be expected to do in a day for the ordinary day's wage without any special inducement. The premium is earned only by the work which is done in excess of the regular day's work, and the premium earned is according to the time saved in doing the work. If double the work is done in the given time then one-half the time is saved and the man is paid one-half in addition to his regular wages. If the man does one and a half times his day's work then one-third of the time is saved and he is paid one-third more than his day's wages, and so on. The basis of computation is thus fixed and cannot be juggled with, but the inducement constantly decreases with the amount of work done, so that whatever a man may do he can never by any possibility double his earnings. Mr. Halsey's premium plan, of course, requires no explanation here, and it will be designated hereafter as *the* premium plan.



Part Plan of Coaling Station.

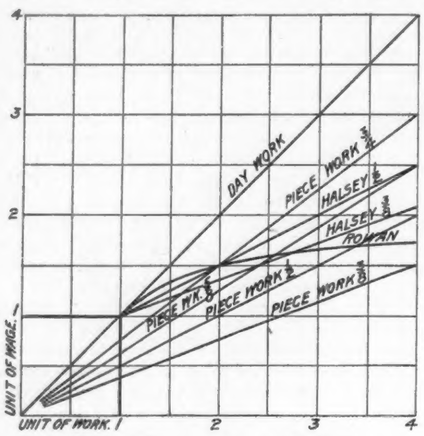
Referring to the diagram it will be seen that both day work and piece work, whatever the rate of the latter, are represented throughout by straight lines. A discouragement curve represents the Rowan premium system and Mr. Halsey's premium plan has a bend sinister. It was impossible to include Mr. Gantt's bonus system in the diagram because a part of it, the part where you do not quite earn the bonus, must be represented by an *invisible* line.

In the premium plan the work which is done in the earning of the premium is straight, absolute piece work. The name cannot disguise it. The line in the diagram for the premium plan at one-half rate is exactly parallel to the half rate piece work line, the wages earned rise equally in each with equal increments of work done. So the three-eighth premium rate is parallel to the three-eighth piece work rate, and so on. If in making the premium plan bargain, the proposition were made to the man to first do his allotted quota and be credited with his day's wages and that then he should go to work by the piece for the remainder of the day at one-half the day rate, that would be the premium plan in every particular.

The partial piece-work character of the premium plan being undeniable, a paper whose topic is piece work must claim the right to handle it freely and without apology. The premium plan was invented by its originator 19 years ago; it was put in operation in the shop at Sherbrooke, Canada, 13 years ago, and was first brought to the notice of this Society in a paper 12 years ago. The plan, I know, has been proposed and advocated in all honesty of purpose; it has been pushed with earnestness and persistency. As a result the premium plan is in operation in a few machine shops and nowhere else. Perhaps two per cent. of the machine work in the United States is done under the premium plan, while ten times as much is done by undisguised piece work and much more than half is still done by the day.

It is not at all apparent that there are any peculiar

conditions in the machine shop which demand any different plans of wage adjustment than are prevalent in the other trades. While a knowledge of the premium plan is now widespread, the plan has not made itself appear so good a thing that any of the other trades have taken it up. It would not work with the shoemakers of Lynn, the hatters of Danbury, the glovemakers of Gloversville, or the stitchers and starchers in the collar shops of Troy, for they all work by the piece, as do most of the manufacturing trades, and the ultimate possibilities of economical production are



Piece Work and Bonus Systems.

thereby secured as completely as they can ever be claimed to be under the premium plan.

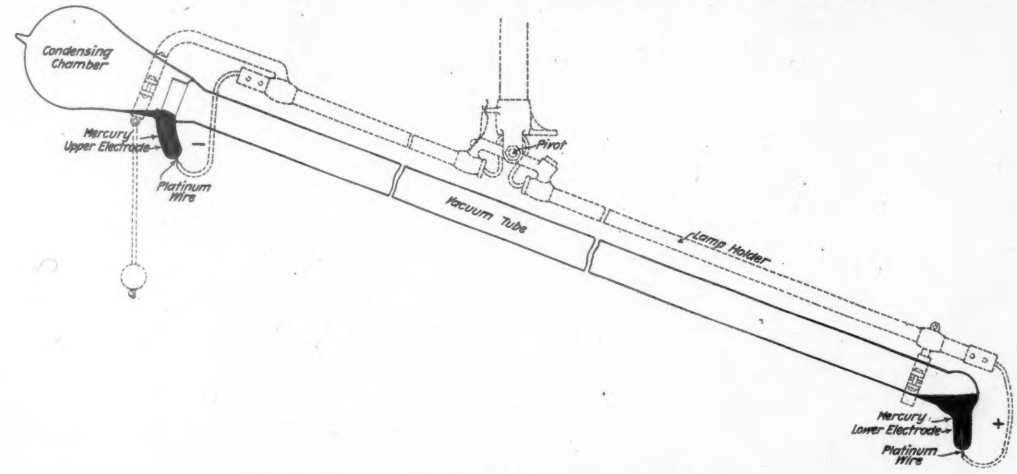
We might by an effort imagine the effect of proposing the premium plan to one of the trades outside the machine shop. Let it be tried on a lot of bricklayers. Say that it is first agreed that the day's wages are earned when 500 bricks are laid, and that the premium plan begins right there. The bald proposition is, first, that if 500 bricks are laid 500 bricks will be paid for. This is so far meant to be an honest bargain on both sides. If you don't lay another brick above the 500 we will have no cause of complaint. Having agreed to pay for the laying of the 500 bricks, when the 500 bricks are laid go on and lay as many more as you can. If you lay 750 bricks we will pay you for laying 625 bricks; if you lay 1,000 bricks we will pay you for laying 750 bricks, and so on. It will be very plain that under this arrangement the workmen are clearly the gainers, for if you lay more bricks you get some more money, and every additional cent you get is, of course, clear gain to you. The absurdity of this thing, when dealing with bricklayers, is sufficiently evident; are machinists so vastly different from bricklayers?

One of the inherent and inseparable conditions of the scheme would seem to be the voluntary acceptance of it by the individual workman. It depends entirely upon himself how much the man shall do after the allotted amount for the day's work is done. He may do much or he may do little, and therefore if he so chooses he may do none at all, but just be content to work along at his usual rate and just earn his day's wages. The premium plan as I understand it is ostensibly, entirely a coaxing and not at all a driving plan; and yet it is a matter of common knowledge that in the State of New York alone there have been two determined strikes against the premium plan in the past year. This seems odd. If you don't choose to do what you are formally and distinctly allowed to choose whether you will do or not, what possibility for a strike can there be in that? Can it be that premium plan enthusiasts sometimes venture to put on to the plan some features which do not belong to it? I cannot imagine any other way in which a strike could be possible.

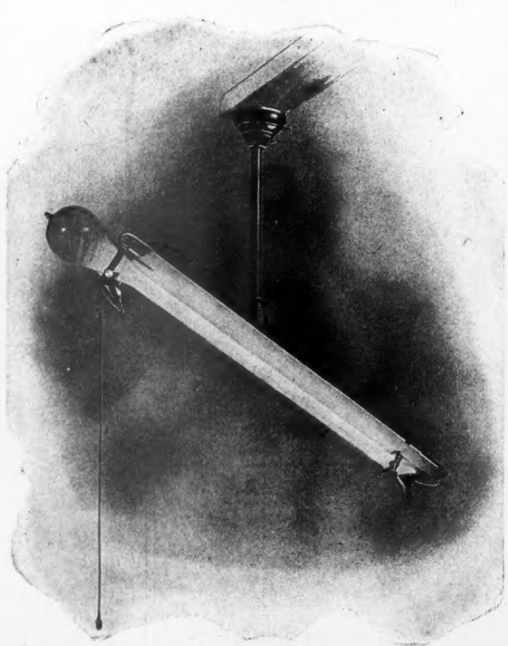
If they can tag things on and objectionally modify the premium plan they can also knock things off. The one essential safeguard of the premium plan continually insisted upon is that there shall be no cutting of rates when once established. This must inevitably involve injustice, because prices both of labor and of finished products change continually, and there must be, if justice is to prevail, sometimes a cutting of rates and sometimes an advance of rates. So far as it is possible to fix honest prices, and to maintain them there as long as it is just to both sides to do so, it can be done as well with straight piece work as with any premium plan, and is so done. For instance, I have knowledge of an establishment in the machine line, whose identity I must not disclose, where 1,500 men are employed and where piece work prevails in all departments, so that 90 per cent. of the productive work of the entire establishment is done by piece work, and it may be said of that establishment that there is no cutting of rates there, just as truly as I suppose it is ever said of works where the premium plan is in use. All prices when made run for a year. They are not arbitrarily imposed by the employer or his representatives, but are the outcome of fair and free and friendly conference, and when changes of price are imperative they are adjusted again in the same way. The works are prosperous continually, and the relation of employers and employees are less strained than they were under other arrangements.

It must be evident that none of these premiums or bonus, or other curved or bent, or defective line schemes, whatever they may claim in the way of quickening the pace of the worker and increasing the output, can be the most effective, for the reason that they offer a reduced incentive at the precise time when the need of incentive is most urgent. It is the last piece done which comes the hardest, and it is absurd to offer the man half-price or less for doing it. With either of the premium plans doing its best in the way of increased output and reduced labor cost per unit, and with piece-work prices adjusted to precisely the same price per piece, the inducement to the worker to increase his output still further must be greater under the piece work than under the premium plan. The guarantee that prices shall not be cut is precisely as applicable to piece work as to the premium plan. The latter has absolutely no monopoly of honesty, no assurance of price maintenance any more than the other. With equal temptation to cut, and with the same human nature in the boss, the chances of cutting will average precisely equal.

With no one having the slightest interest in pushing or advertising piece work, it is advancing on its merits as the most honest way of paying for repetitive work in the machine trade as in all others. It is worth while to note its popularity and progress especially in the extensive line of railroad work. The testimony at the meetings of the various railroad organizations is very pronounced in this direction. At the meeting this summer of the Railroad Master Blacksmiths one man said that absolutely every job in his shop was done by the piece. When the price could not be placed on the work to be done it was placed on the "heat."



Hewitt Mercury Vapor Lamp, Showing Construction.



The Hewitt Mercury Vapor Lamp.

The Hewitt Mercury Vapor Lamp.

The principle of the Hewitt lamp is the production of light by passing an electric current through mercury vapor, and it is one of the oldest ever applied to the generation of light by electricity. Probably the first really successful mercury vapor lamps were made in 1892 by a German named Arons. These lamps developed a great deal of heat and proved unsatisfactory for illuminating purposes, as they had to be operated under a stream of water to keep them cool. Mr. Cooper Hewitt, after long and careful investigation and experiment, has overcome the difficulties heretofore encountered and has obtained a commercially successful mercury vapor light, which is an entirely new departure in practical electric illumination.

The lamp, as shown in the illustration, is made of a glass tube, to which is sealed the condensing chamber. The current is led into the tube by means of platinum wires, which are sealed in the glass and terminate in the electrodes, one or both of which are of mercury. The tube is exhausted to as high a degree as possible by a vacuum

The Hewitt Lamp in the Drafting Room.

Machine Shop Lighted with Hewitt Lamps.

pump and sealed to maintain the vacuum and to prevent the escape of the vapor which fills the tube.

Mercury vapor, under the conditions existing in the lamp, possesses a high initial resistance to the passage of the electric current; and this resistance which exists between the electrodes must first be broken down before the lamp can be put in operation. To accomplish this, the lamps are constructed so that one electrode is normally on a higher level than the other. The line drawing shows the lamp in its normal position about 20 deg. off the horizontal. The lamp holder is hung on a pivot, and the operation of starting consists in first tilting the lamp, allowing an excess of mercury to flow into the condensing chamber, and then lowering the lamp back into its normal position, allowing the mercury to flow by gravity in a stream down the length of the tube. This stream instantly establishes a metallic connection between the electrodes and then breaks, usually at the bottom where it ends in a spray. The lamp lights across the break, producing a luminous body the entire length of the tube. This method of starting is known as the tilting method, and is the one most generally in use. The lamps are made in 250, 300 and 750 c.p. sizes. They are also made to be operated in a horizontal position, in which case a special starting mechanism is required.

The Hewitt lamp has a high efficiency and economy, and is probably the cheapest source of artificial light yet produced. The current consumption is very low, being about ½ watt per candle power, and the lamps have an average life of 1,600 hours.

The light produced is peculiar to itself. It has a decided greenish tinge, and is entirely lacking in red rays, the absence of which makes it unsuitable to use where it is essential to obtain true color values. The lamps are especially adapted to drafting room and machine shop work, on account of the large luminous surface presented, which eliminates the casting of the annoying sharp shadows produced by lamps with small light giving surface. It is claimed that the absence of red rays makes the light less tiresome to the eyes. On account of the extreme actinic value of its rays, the light is especially recommended for all photographic uses, and blue printing.

A Novel Ash and Cinder Handling Crane.

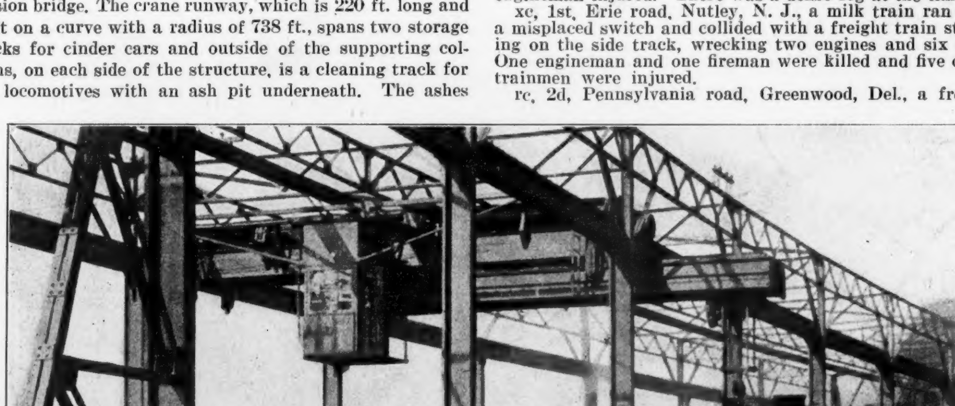
There has recently been installed in the Pennsylvania yard at Thirty-second street and Powelton avenue, West Philadelphia, Pa., a system for disposing of the ashes and cinders dumped from locomotives, which employs an unusual design of electric traveling crane with an auxiliary extension bridge. The crane runway, which is 220 ft. long and built on a curve with a radius of 738 ft., spans two storage tracks for cinder cars and outside of the supporting columns, on each side of the structure, is a cleaning track for the locomotives with an ash pit underneath. The ashes and cinders are dumped into clam-shell buckets placed in the pits and these are raised with the extension bridge, swung inside the main span and carried along the runway and dumped over any car standing on the storage tracks.

The runway is supported on two rows of columns spaced radially and approximately 20 ft. apart with a clear span over the storage tracks of 38 ft. These columns are built up of a plate web and four angles, faced on the inside with a channel. The girders between columns on each side are of box section, 12 in. x 12 in., built of two webs, four angles and top and bottom cover-plates. They rest on seats built in the columns, a portion of each column being extended above the runway to carry the bracing as shown in the illustration. The bracing consists of three rows of longitudinal latticed girders of the Warren type, one over each row of columns and one down the center of the runway with transverse latticed girders framed into the intermediate longitudinal girder to brace opposite columns in the structure. Diagonal braces are also framed into each bay.

The main bridge of the crane is made of two heavy I-beams and top and bottom cover plates, forming a box section. It is mounted on four wheels, two on each side, which run on the longitudinal box girders resting on the supporting columns. A 10 h.p. motor is used to operate it and this gives a maximum longitudinal travel under full load of 250 ft. per minute and 300 ft. per minute under no load. The travel is under complete control by means of a special foot brake, operated from the cage.

The auxiliary bridge is carried from the main bridge by six brackets having small steel wheels engaging with the top outside flanges of the two I-beams of which the auxiliary bridge is composed. Tilting of the auxiliary bridge under load is prevented by the upper guard rails engaging with rollers on the under side of the main bridge. It is operated with an 8 h.p. motor and rack movement and has a maximum transverse travel of 75 ft. per minute under full load and 100 ft. per minute under no load. The hoisting trolley runs on rails attached to the bottom inside flanges of the auxiliary bridge. When the extension is run out to its farthest point the trolley has a reach of 11 ft. 9¼ in. on each side beyond the normal span of the upper bridge, giving a total span of 59 ft. 6½ in. A 15 h.p. motor gives a maximum hoisting speed under the full load of 3 tons, of 60 ft. per minute and 150 ft. per minute under no load; the total lift possible is 18 ft. The maximum trolley travel across the runway is 100 ft. per minute under full load and 150 ft. per minute light, this operation being performed with a 2 h.p. motor.

A suspended framework is attached to the trolley and on its lower end is fixed a dumping ring. When the loaded bucket is hoisted high enough to come in contact with this ring, the bucket arms are released and the load is dumped into any car over which the trolley may be placed. The operator's cage is placed in the middle of the crane span and is hung from the upper bridge. This position permits all the operations to be within sight of the operator. The cage contains four reversible controllers and the other mechanism necessary. Special provision is made to protect all the parts from the excessive dirt and dust arising from the handling of ashes. Direct current at 220 volts is used for all the motors and is taken from two main conductors strung along the inside of the crane runways. The whole installation was designed and built by Pawling & Harnischfeger, Milwaukee, Wis.



Special Ash Handling Crane in the Pennsylvania Yards at West Philadelphia.

Train Accidents in the United States in December.[1]

bc, 1st, Southern Pacific, Montello, Nev., butting collision between a freight train and a train consisting of a live and a dead engine. One fireman was killed and one engineman injured. There was a dense fog at the time.

xc, 1st, Erie road, Nutley, N. J., a milk train ran over a misplaced switch and collided with a freight train standing on the side track, wrecking two engines and six cars. One engineman and one fireman were killed and five other trainmen were injured.

rc, 2d, Pennsylvania road, Greenwood, Del., a freight train which had slackened speed preparatory to entering a side track was run into at the rear by a following freight, and 20 cars were wrecked. A few minutes after the collision a car of naphtha exploded and the explosion did great damage, one hundred or more dwelling houses having windows broken and some of them being wrecked. Five dwelling houses were burned to the ground. Two persons were killed and many others were injured. The engineman and fireman of the colliding freight jumped off and were badly injured, and 500 people suffered from the effect of the explosion. The signalman in a tower near the point of collision was injured by the wrecking of his building.

rc, 2d, Michigan Central, Lapeer, Mich., a local freight, standing at the station, was run into at the rear by a following freight and the caboose and several cars were wrecked. The conductor was killed.

xc, 3d, Norfolk & Western, near Portsmouth, Ohio, a yard engine collided with a passenger train, wrecking both engines. Two employees were injured, one of them fatally, and 10 passengers were injured.

xc, 4th, Pennsylvania road, Mt. Etna, Pa., collision of freight trains; conductor and one brakeman injured, the latter fatally.

xc, 4th, Crooksville, Ohio, a locomotive of the Zanesville & Western ran into a passenger train of the Cincinnati & Muskingum Valley at the crossing of the two roads and one passenger car on the rear of train occupied by laborers was overturned. One employee was killed and 11 employees injured, 3 seriously.

*rc, 4th, 7 p. m., Union Pacific, Council Bluffs, Iowa, a passenger train of the Chicago & North Western ran into the rear of a preceding freight of the Chicago, Milwaukee & St. Paul, wrecking the caboose and one car. The wrecked cars took fire and were burnt up. The passenger fireman jumped off and was injured.

rc, 5th, 1.30 a. m., Boston & Albany, Worcester, Mass., a westbound passenger train ran into the rear of a preceding freight at the entrance to the yard, and the caboose and several freight cars were wrecked. The conductor and two brakemen of the freight were killed.

xc, 5th, Norfolk & Western, Seven Mile Ford, Va., some cars in a freight train ran against the engine of another freight standing on a side track, badly damaging several cars. One engineman was fatally injured.

xc, 7th, Brunswick & Birmingham, Hortense, Ga., a freight train collided with a freight car which had been left standing on the main track, badly damaging the engine and car. The engineman and one brakeman were killed and two other trainmen were injured.

8th, Jacksonville & St. Louis, Washville, Ill., the engine and several cars of a gravel train were derailed and the fireman was killed; the engineman was injured.

dr, 8th, Atlanta & West Point, La Grange, Ga., a passenger train was derailed at a switch, apparently by the breaking of the switch rod, and a dining car and two sleeping cars were overturned. Three passengers and three trainmen were injured.

†*dr, 10th, Pittsburg, Cincinnati, Chicago & St. Louis, New Cumberland Junction, W. Va., passenger train No. 15 was derailed at a misplaced or defective switch and the engine fell against another engine on an adjacent track. One passenger was killed and 15 persons were injured.

eq, 11th, Louisville & Nashville, Georgia, Ala., passenger train No. 28 was derailed, apparently by a broken truck and three passengers were injured.

rc, 12th, Chesapeake & Ohio, Lewis, W. Va., a freight train ran into the rear of a preceding freight; engineman and two other trainmen injured, the former fatally.

rc, 12th, Wabash road, Brunswick, Mo., passenger train No. 12 ran into the rear of a preceding freight which had been unexpectedly stopped, badly damaging the engine and several cars. The fireman was killed and the engineman and several passengers were injured. It is said that the flag sent out by the freight was unheeded on account of a snow storm.

bc, 12th, 10 p. m., Pittsburg, Cincinnati, Chicago & St. Louis, Wheeling, W. Va., butting collision between northbound passenger train No. 220 and the second section of southbound train No. 215, consisting of a yard engine and four cars of live stock. Both engines were wrecked and both firemen were killed. One engineman, the baggageman and two passengers were injured. Train 220 had just arrived at Wheeling as the first section of train 215, and the men in charge appear to have turned and started northward, forgetting that the second section of 215 was following.

dn, 13th, Baltimore & Ohio, Piedmont, W. Va., a freight train became uncontrollable on a descending grade and its two engines and 24 loaded cars fell down a bank. Both enginemen, one fireman and one brakeman were killed and three other trainmen were injured, one of them fatally.

bc, 13th, Chicago, Milwaukee & St. Paul, Adel, Iowa, butting collision between a westbound freight, with two engines and an eastbound freight, wrecking the three engines and 14 cars. Two enginemen and one fireman were killed and four other trainmen were injured. It is said that the collision was due to a mistake in telegraphic orders.

*†unx, 13th, Chicago, Burlington & Quincy, Albia, Iowa, a westbound passenger train was derailed as it entered on Cedar Creek bridge and five cars were wrecked by running against the bridge trusses. The wrecked cars at once took fire from coals falling out of the stove and the cars and a part of the bridge were burnt up. A woman and her infant daughter and one other passenger were killed and 12 passengers were injured.

xc, 14th, Erie road, Rochelle Park, N. J., a freight train ran over a misplaced switch and collided with the engine of a freight train standing on the side track, damaging both engines and several cars. One fireman and 20 laborers were injured.

dn, 14th, 1 a. m., Chicago, Milwaukee & St. Paul, Ranney, Wis., fast mail train No. 56 was derailed at the derailing switch at the crossing of the Chicago & North Western, and the engine and four cars were ditched.

dn, 15th, 9 p. m., Michigan Central, Toledo, Ohio, passenger train No. 307 was derailed at a misplaced switch and the engine and first car were badly damaged; engineman and fireman injured. It is said that the switch was misplaced maliciously.

unx, 15th, 5 a. m., Chicago, Burlington & Quincy, Malvern, Iowa, a westbound express train was derailed and the engine was overturned. The engineman was killed and the fireman injured.

unx, 15th, Atlantic & North Carolina, Hines, N. C., a freight train was derailed and the engine was overturned. One brakeman was killed and two other trainmen were injured.

rc, 16th, St. Louis & San Francisco, Pawnee, Kan., a freight train ran into the rear of a preceding freight, badly damaging the engine and caboose. A brakeman on the engine was burned to death by being pinned against the boiler of the engine, and two other trainmen were fatally injured. The collision occurred on a bridge.

bc, 16th, 11 p. m., Southern Railway, Dogwood, Ala., butting collision between freight trains No. 85 and No. 64, wrecking both engines and six cars. One trainman was killed and five were injured.

xc, 17th, 11 p. m., Illinois Central, Church, Ill., a passenger train ran into the rear part of a preceding freight which had broken in two, leaving a part of its cars to run back down grade toward the passenger train. The passenger fireman was killed and the engineman and several passengers were injured.

dr, 18th, Chicago Great Western, Northfield, Minn., passenger train No. 210 was derailed by a broken rail and five passengers and two trainmen were injured.

xc, 18th, Oregon Short Line, Bliss, Idaho, some freight cars which were left standing on the main track were run

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

into by a passenger train, and the engineman and fireman were seriously injured.

rc, 17th, Kansas City Southern, Many, La., a freight train which had been unexpectedly stopped on account of some disablement of the engine was run into at the rear by a following freight, and the engineman of the standing train, who was under his engine, was killed.

bc, 18th, 5 a. m., Illinois Central, Rialto, Tenn., butting collision between southbound train No. 155, third section, and northbound freight No. 152, wrecking both engines and several cars. One fireman was killed and five other trainment were injured. The southbound train was standing at the station, waiting for the northbound, and it appears that the men on the engine on the latter had fallen asleep. The flagman of the standing train was also asleep.

bc, 18th, Erie road, Rowlands, Pa., butting collision between a passenger train and freight, badly damaging both engines and several cars. Two trainmen and two passengers were injured.

unx, 18th, Chicago Great Western, Northfield, Minn., a passenger train was derailed and two of the three passenger cars were overturned. Six passengers and three trainmen were injured.

*bc, 20th, Cleveland & Pittsburg, Salsbury, Ohio, butting collision of freight trains, wrecking three engines and ten cars. One brakeman was killed and several other trainmen were badly injured. The wreck took fire and was partly burnt up. It is said that the collision was due to a mistake of an inexperienced brakeman, who, having been sent out to flag one of the trains, returned on a whistle signal which was intended for a flagman on another track.

bc, 21st, 3 a. m., Alabama Great Southern, Cottonvale, Ala., butting collision between a southbound passenger train and a northbound freight. Four passengers and three trainmen were injured.

†dn, 21st, 6 a. m., St. Louis & San Francisco, Godfrey, Kan., a southbound passenger train was derailed by running into a side-track at full speed, and the engine and several cars were overturned. Five passengers and five trainmen were killed and 32 other persons were injured. The switch had been set for the side-track because of the presence of a freight train on the main line and it appears that the men in charge of the freight failed to notify the passenger train to slacken speed.

bc, 23d, Southern Railway, Knoxville, Tenn., butting collision of freight trains, badly damaging both engines and several cars. One fireman was fatally injured.

bc, 23d, Louisville & Nashville, Morris, Ala., butting collision of passenger trains. One mail clerk killed and six passengers and five trainmen were injured.

†unf, 23d, 8 p. m., Baltimore & Ohio, Laurel Run, Pa., eastbound passenger train No. 12, running at high speed, was derailed by timber lying on the track which had fallen

xc, 25th, 11 p. m., Southern Railway, Clifton, Va., passenger train No. 218 collided with the rear portion of a freight train which had broken loose and had run down a grade. Five trainmen were injured.

†bc, 26th, 8 p. m., Pere Marquette road, East Paris, Mich., butting collision between westbound passenger train No. 5 and eastbound passenger train No. 6, both running at full speed. Both engines and three or four cars in each train were completely wrecked, and 17 passengers and 5 trainmen were killed and 29 passengers injured. There was a blinding snow storm at the time. The collision was due to the failure of the engineman of the westbound train, No. 5, to heed a train order signal set against him at McCord's. It is said that the light of the train order signal had been extinguished by the wind. This collision was reported in the *Railroad Gazette* of January 1.

bc, 26th, Wabash road, Worden, Ill., butting collision between a northbound passenger train and a southbound freight, badly damaging both engines. Four trainmen and six passengers were injured.

*xc, 26th, Cincinnati, New Orleans & Texas Pacific, Williamstown, Ky., collision between a freight train and a wrecking train, wrecking several cars. The sleeping car of the wrecking train took fire and two of the employees were burned to death. Nine other employees were injured.

*rc, 27th, 9 p. m., Chicago & Eastern Illinois, Tangier, Ill., a freight train which had been unexpectedly stopped by a hot bearing in the engine was run into at the rear by a following freight, and the engine and caboose were wrecked. The wreck took fire from the stove in the caboose and was partly burnt up. The engineman of the standing train was beneath his engine and was killed, and the engineman of the other train jumped off and was badly injured.

*bc. 27th, Northern Pacific, Hinckley, Minn., butting collision between a passenger train and a freight, badly damaging both engines. One mail car took fire and was burnt up, and a mail clerk was burned to death.

o, 27th, Baltimore & Ohio, Akron, Ohio, the locomotive of a freight train was wrecked by the explosion of its boiler, and the fireman and one other trainman were killed and a brakeman was fatally injured.

xc, 28th, 4 a. m., Pennsylvania road, Rahway, N. J., an eastbound freight train on track No. 2 broke in two, and the rear portion afterward ran into the forward one, wrecking several cars. A part of the wreck lodged on track No. 1 and fast mail train No. 18 ran into it. The engine of this train was damaged and the fireman was killed.

dn, 28th, Philadelphia & Reading, Phoenixville, Pa., a mixed train was derailed at a misplaced switch and the engine and several freight cars fell down a bank. One passenger and one trainman were injured.

a freight train was wrecked by the explosion of its boiler, and the fireman, a track walker and a bystander were killed. Five other persons were injured.

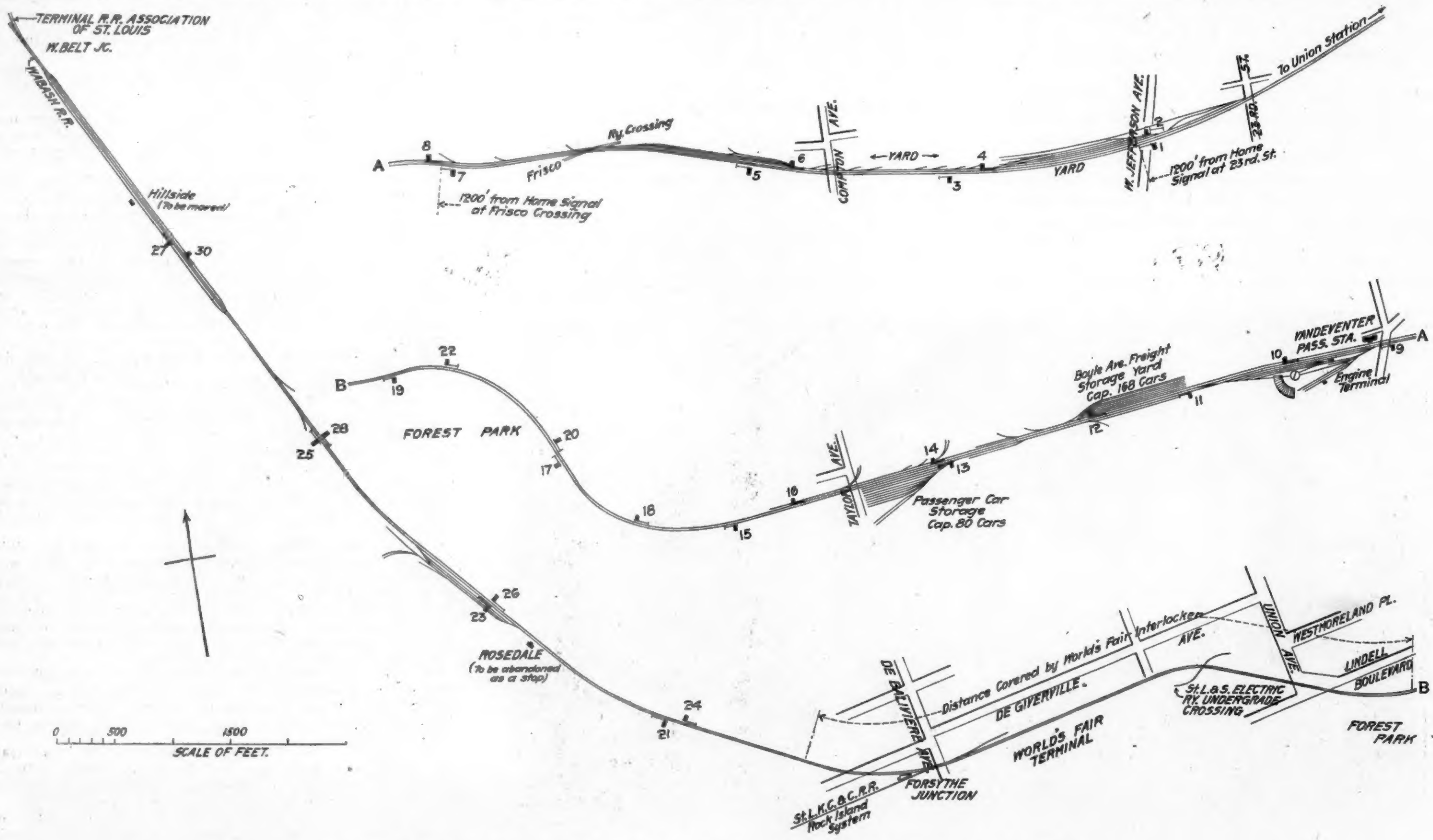
dr, 30th, Northern Pacific, Tuscor, Mont., a passenger train was derailed by a broken rail.

31st, 6 a. m., Lake Shore & Michigan Southern, Ashtabula, Ohio, eastbound passenger train No. 22, drawn by two engines, was derailed at a misplaced switch and both engineman and one fireman were killed and one fireman was injured. The proper setting of the switch had been delayed by difficulty in clearing away snow. The switch was suitably protected by signals, however, and the derailment appears to have been due to disregard of signals.

bc, 31st, Baltimore & Ohio, Barton, Ohio, butting collision between a freight train and a train consisting of an engine and a caboose. The light engine started backwards unattended and ran some distance. One brakeman and one engineman were injured, the brakeman fatally. The collision was due to an error on the part of one of the enginemen, who mistook a special train for a regular.

The Wabash Terminal at the World's Fair Grounds, St. Louis.

By reason of its location, the Wabash will bear much the same relation to the St. Louis World's Fair that the Illinois Central bore to the Columbian Exposition at Chicago in 1893. Forest Park is in the extreme western part of the city and the Union Station is due east of it in the eastern central part of the city. Starting from the Union Station, the Wabash runs almost directly west to Forest Park, turning northwest at the eastern boundary of the latter and running through its northeast corner. Emerging from the park at Union avenue, it parallels the north park line for half a mile, to Forsythe Junction, the crossing with the St. Louis, Kansas City & Colorado (Rock Island), and again swings to the northwest and north, crossing the line of the Terminal Railroad Association of St. Louis at West Belt Junction, 2 miles further on. It is probable that excursion trains from east of the Mississippi will be run via the Merchants' Bridge, the Terminal's line and the Wabash, direct to the fair grounds. Regular trains from the east will discharge at the Union Station as usual.



Block Signals on the Wabash Main Line Between Union Station and Page Avenue, St. Louis.

(The three sections join from left to right, A to A, B to B.)

from a westbound freight which had just passed on the adjoining track. The engine fell down a bank and the baggage car and smoking car lodged on the boiler. Escaping steam from the dome of the boiler scalded the occupants of these cars, and altogether sixty-two passengers and three trainmen were killed and three passengers and one trainman were injured. The car containing the timbers which fell off was said to have been loaded at Friendsville, Md. This accident was reported in the *Railroad Gazette* of January 1.

rc, 24th, Northern Pacific, Elk River, Minn., a passenger train ran into a preceding freight, wrecking the caboose; one brakeman was burned to death.

bc, 24th, 5 a. m., Wabash road, Mexico, Mo., butting collision between an eastbound passenger and a westbound freight, wrecking both engines and several cars. The freight engineman was killed and two trespassers were injured.

rc, 25th, Pittsburg, Fort Wayne & Chicago, Fifty-fourth street, Chicago, Ill., collision between a passenger train of the Fort Wayne road and a freight of the Chicago, Milwaukee & St. Paul, due, it is said, to a failure or mistake in flagging; four employees injured, including one, the flagman to whose neglect the collision is said to have been due, fatally.

xc, 25th, Kokomo, Ind., a freight train of the Pittsburg, Cincinnati, Chicago & St. Louis ran into a passenger train of the Toledo, St. Louis & Western, wrecking two passenger cars. Five passengers were injured.

unf, 28th, 11 p. m., Pittsburg & Lake Erie, New Castle Junction, Pa., a westbound express train was derailed and five cars were ditched. It is said that a spike had been maliciously placed on the track for the purpose of derailing the train.

bc, 29th, Illinois Central, Paducah, Ky., passenger train No. 10 ran over a misplaced switch and into the head of a freight train standing on the side track, wrecking both engines and a mail car. Both enginemen, three other trainmen and two passengers were injured, the engineman fatally.

bc, 29th, about 5.30 a. m., Pittsburg, Fort Wayne & Chicago, Larwill, Ind., butting collision between a westbound passenger train and an eastbound freight, making a bad wreck. Three trainmen were killed and one passenger, three trainmen and a boy riding on the engine were injured. It is said that the freight engineman had received an order giving him until 5.30 to reach Larwill, but that he read the order 6.30.

dr, 29th, 2 a. m., Chicago, Burlington & Quincy, Fenton, Ill., a freight train was derailed, presumably by a broken rail, and the engine and 9 cars fell down a bank. The fireman and one brakeman were killed and the engineman was fatally injured.

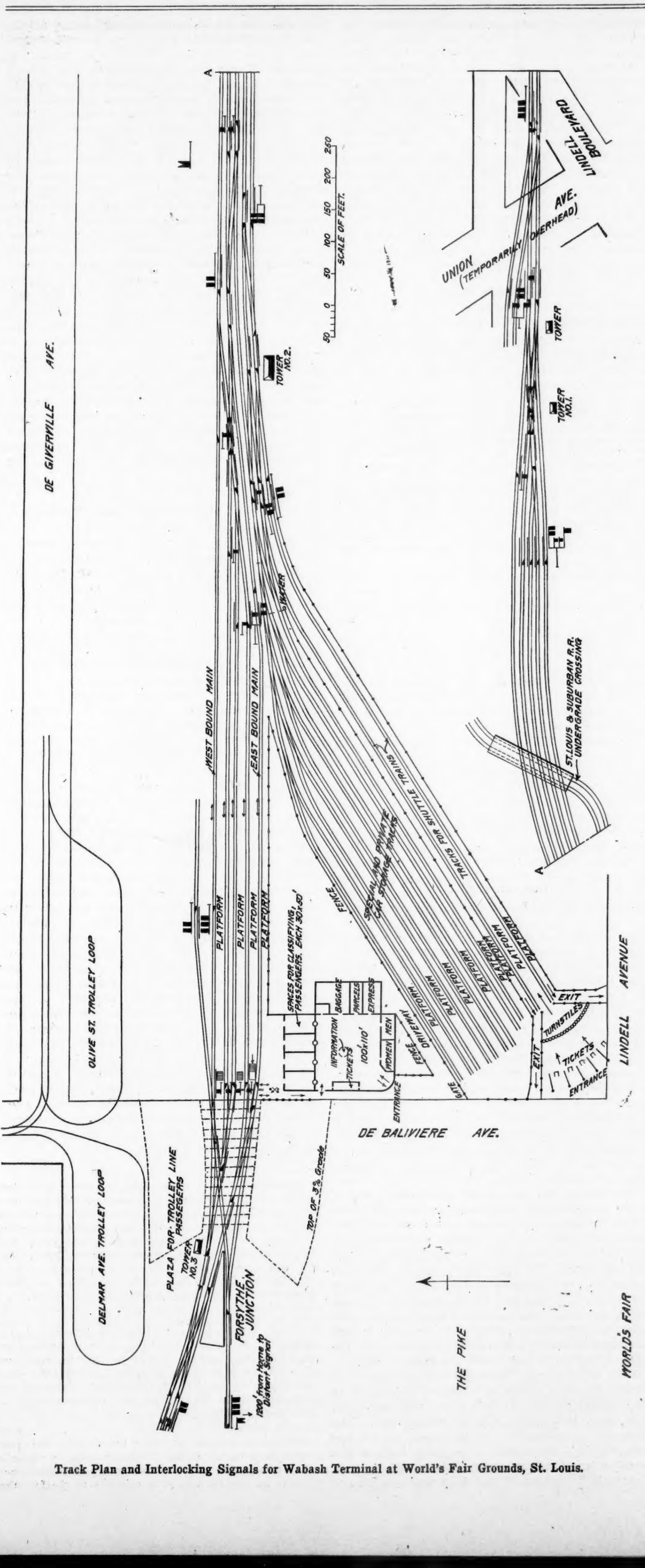
unf, 29th, 4 a. m., Louisville & Nashville Pleasant View, Ky., a passenger train was derailed by a rock which had fallen on the track and the engine was badly damaged. A mail clerk was injured.

o, 29th, Erie road, Hankins, N. Y., the locomotive of

The plans of the transportation facilities and World's Fair terminals of the Wabash have been carefully worked out by President Joseph Ramsey, Jr., and two engravings, showing respectively the terminals at the fair grounds and the plan for proposed block signaling between the Union Station and Page avenue (West Belt Junction) are presented herewith.

The special service between the fair grounds and the Union Station contemplates the use of shuttle trains, and it is expected to be able to handle 36,000 people an hour. The trains will be made up of specially-constructed cars without steps, having transverse seats extending clear across and doors on both sides at each seat, similar to open street cars. Their seating capacity will be 120, and they will be run in 10-car trains, or 1,200 persons per train. With trains at two-minute intervals, the 36,000 people an hour, above mentioned, will be provided for.

The Wabash now has a double track from the Union Station to Page avenue. At Union avenue the number of tracks is increased to five as far as Forsythe Junction. These additional main tracks are for through trains east and west, which will discharge passengers at the fair grounds. Platforms long enough to accommodate respect-



Track Plan and Interlocking Signals for Wabash Terminal at World's Fair Grounds, St. Louis.

ively 14, 11, 10 and 8 cars are placed between these tracks, and the passengers discharged from these trains will walk west on the platforms to the stairs shown, and will descend into De Baliviere avenue, which, during the fair, will be lowered to pass under the railroad's tracks, and will be used by pedestrians only. From the subway to the entrance to the fair grounds, the avenue will be widened to 300 ft., forming a broad plaza-approach. Loops for both the Delmar avenue and Olive street trolley lines are to be put in just north of the De Baliviere avenue subway, through which the passengers on these lines must pass to the fair grounds.

Facing on the De Baliviere plaza will be the Wabash station for through trains. It will have a main waiting room 100 ft. x 100 ft., with an information bureau in the center. Adjoining the waiting room on the west will be baggage, parcel and express rooms. On the north are four spaces for classifying passengers, each 30 ft. x 50 ft. The object of these compartments is to avoid confusion and to facilitate handling the passengers to the through trains. For instance, announcement that a certain train is to depart at a certain time is displayed over a compartment, and only passengers having tickets for that train will be admitted to that compartment. The entrance from the compartment to the track will be opened only when the train is announced.

The shuttle train business will be handled entirely from the station at the corner of Lindell and De Baliviere avenues, which is directly opposite to the main entrance to the fair grounds. Eleven stub tracks are shown back of this station. Only two will be used for the shuttle trains and these two will be enclosed by fences in each side. The remaining nine tracks will be for storage of shuttle trains during slack hours and for private cars, etc. The shuttle trains will head in on these two tracks, and for each train an extra locomotive will be waiting to couple on to the rear while it is discharging and loading passengers, and will haul it on its return trip. The locomotive bringing the train in becomes the extra for the next train, backing down and lying in the clear on the cross-over where "Water" is marked on the drawing. The two tracks marked for shuttle trains will be kept clear of traffic as far east as Union avenue, where they converge with the other main tracks into the double track to the Union Station.

It is thought that the only possible point of serious congestion in the service planned will be at the Union Station where other trains might possibly interfere. However, it is the intention to have two tracks on the west side of the train-shed reserved exclusively for this service. Both at this point and at the World's Fair end there will be platforms on a level with the floors of the cars. Passengers unloading will go to the outside platforms, while those wishing to board the train can only enter, through turnstiles, to the middle platform, their tickets being taken before passing through the turnstiles.

The engravings also show the plan of the proposed block signaling between the Union Station and Page avenue, and the complete track plan between these points except at the World's Fair Station, as the block system is broken at the east and west limits of the World's Fair interlocking. From the home signal at 23rd street, near the Union Station, to West Belt Junction, exclusive of the World's Fair interlocking, which is about 5,500 ft., the distance is about 5 miles, and it will be divided into 15 blocks, equipped with automatic electric block signals. Trains will run at two-minute intervals and will make the trip in 10 minutes.

Four interlocking plants will be installed, one at Page avenue and another at Forsythe Junction. The third is the World's Fair machine, marked Tower No. 2, and the fourth is at Union avenue. The World's Fair machine will have 52 levers with only one spare, and the Union avenue machine will have 28 levers if no connection is made to the Rock Island at this point and 32 levers if the connection is made.

There will be an overhead crossing at Union avenue as a sewer prevented building a subway for the street. A bridge with long approaches will be put in.

We are indebted to Mr. W. S. Newhall, Chief Engineer, for the plans and for information

Foreign Railroad Notes.

The Prussian State Railroads have increased their order for new locomotives for the coming year from 445 to 606. All must be delivered before December, 1904.

Press despatches of January 26 report that the French Chamber of Deputies has rejected a proposal for the purchase by the State of the Western Railroad of France. This proposal is said to have been the beginning of an intended movement to have the whole of the railroads of the country bought by the government. The leader of the opposition to the project was M. Rouvier, Radical Republican. He says that the existing agreements between the government and the railroads are decidedly beneficial to the government treasury.

Either the Belgian State Railroad accounts are very obscure, or some members of the Belgian Parliament are very dumb. The latter has a committee whose duty is to report on the railroad accounts. One of this committee affirms that the figures are deceptive, and that in reality the railroads incurred a deficit of 38,000,000 francs last year. Another, belonging to the same party, declares on the other hand that they are one of the chief sources of the national income.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 83 Fulton Street, New York.

The record of the application of high-speed reducing valves to the quick-action Westinghouse brake on passenger equipment is exceptionally interesting. About one-third of the passenger locomotives, tenders and cars of this country now have the high-speed brake attachment, and nearly all of these applications have been made within the past 30 months. Its history has a value, because in this concrete case we have the time intervals between the discovery of the basis principle, the invention of the device, the experimental stage, the time test and the general use of an improvement in the art of transportation. It has progressed under normal conditions, without public outcry, or compulsory legislation, or pressure of any kind, even by the manufacturers who rightly considered that this additional cost should not be unduly pressed upon the railroads during the period of their heaviest outlay for equipping freight trains with automatic couplers and brakes. The safety of freight-train crews and yardmen was paramount. The safe and economical carrying of passengers at extraordinary speed could well wait until the railroads could afford to accomplish this without detriment to their more important public functions. The lesson, if there is a lesson from this voluntary and apparently enthusiastic provision for safe high speed, does not seem to be that government supervision is not desirable, but rather it is an indication of the wisdom and caution needed in those who may be chosen to represent the public in studying the intricate problems of transportation. The principle on which the high-speed valve is based—that for the quickest stopping the brake-shoe pressure should be a function of the speed—was developed by the Westinghouse-Galton experimentsin England 25 years ago, and the result aimed at was secured, experimentally, in 1893-4 on the Empire State Express and on the Congressional Limited trains. It was thereafter, in the words of one of those interested, "kept in the show case" for four to five years. Practically no high-speed brakes were furnished commercially prior to 1898. The number of high-speed reducing valves supplied by the Westinghouse Air-Brake Co. to railroads in this country up to July 31 in each year is as follows:

1898	45
1899	121
1900	441
1901	948
1902	2,997
1903	13,726
1903 (Dec. 31)	2,547
Total	20,825

In the earlier years, as above listed, the applications were made only to the well advertised through trains which maintained continuous high speed with few stops. In this service its reliability was proved, and there was also full confirmation of the results of the experiments, namely, that its proportionate gain over the quick-acting brake in shortness of stop is practically the same for all speeds above 40 miles per hour; and also that this gain amounts to more than 25 per cent. It was in those earlier years pointed out in these columns that: "Trains of continuous high speed need the protection of efficient brakes rather less than those which, because of frequent stops, can keep their lower averages of speeds only by frequent bursts of high speed." The equipment of local and suburban trains has been the main business of the past year or so, and has reached the enormous proportions shown in the table above.

A Dangerous Rule.

A superintendent of a division of a great railroad system a few weeks ago issued an employee's receipt for a new time-table, and on the face of the receipt was repeated a special rule (apparently a new one) as follows:

> I have this day received a copy of Time-table No. — . . . and understand that . . . "trains of all classes, except regular passenger trains, must approach all stations under control so that it shall not be possible for them to strike any train that may be inside the yard limits. The entire responsibility in such cases rests with the approaching train.
>
> "When at stations, trains carrying passengers must be protected against approaching trains at all times and under all circumstances, even if they are inside of yard limits. It will be understood that yard limits extend to the outside switches unless otherwise designated by yard-limit signs or special rules." I have this day read and understood above special rule.

The double emphasis given by repeating this newly designed safety appliance on the employee's receipt form was further re-enforced by printing it in italic types, indicating to the employee a state of excitement at headquarters. He could almost hear his superintendent saying: "The Indianapolis yard accident was awful, awful; 17 persons killed! Keep your mind continually on that particular tragedy, while in the performance of your multifarious duties, until a new time-table comes out, and then you will get another special wigging."

The results of an accident, whether it is humanly unpreventable, or due to lack of method, or to lack of discipline, are always impressive; but the lesson comes from the cause of it. When it has been caused by failure to obey sound rules, it is well to impress the lesson on the employees, soberly and forcibly; but accidents caused by bad methods suggest a period for a good deal of silence and hard thinking in the superintendent's office. It does no good to shriek hasty special rules to the men, which to some observers, is the basis for what is called the superstition that railroad accidents occur in groups of three.

The first part of the above rule, although not entirely clear, is in accordance with good practice; but the second paragraph, applied to a road where the space interval is not marked and absolute both on the line and at yards and stations, is vicious, in that it is indefinite. Being elastic, the elastic thinking of the trainmen at the station leads them to depend on the protection given by the first part of the rule. At the same time the conductor and engineman of an approaching train, if pressed for time, may neglect to take "the entire" responsibility because they know that a part of it rests upon the trainmen ahead, and so they hurry in and give a chance for the second incident in the group of three. Of course, this is not a valid excuse for the engineman, but he is human, and slovenly rules tend to get just such results.

The trouble with the second paragraph is that it needs interpretation—and interpretation by a lot of human beings under varying circumstances. Perhaps the conductor at the station knows—believes that he knows—that there is no "approaching train," and yet, literally he must either leave a brakeman behind at every stopping station, or put torpedoes half a mile back and wait for the brakeman to come in. If it be said that to protect does not mean the complete carrying out of rule 99, the reply is that partial enforcement is universally admitted to be the cause of all our troubles with the flagging rule.

With block signals, including distants placed to meet the highest speeds, and that strict obedience to them which obtains on roads where they have been long used, this whole rule is unnecessary. But, meantime, an enforcible rule is needed, not one like this, which is an attempt to be doubly sure with a result of practical ambiguity. The second clause is flagrantly obnoxious to the fixed principle that "a rule which cannot be enforced ought not to exist."

We have said that the first part of this rule is good practice; but it needs to be backed by careful instruction. The words, "regular passenger trains," may be assumed by some trainman to exclude freights running as second sections of regular passenger trains. This may appear to him to be justified by the reference in the second paragraph to "trains carrying passengers," which includes some freight trains, and seems to be a direct encouragement to laxness in handling trains not carrying passengers. Such an interpretation makes trouble because a second section has the same right as the first one to run through a yard at speed.

Again, the first paragraph is open to criticism by reason of the insufficient definition of the location of the yard-train. According to the engineman's testimony, it was to this particular insufficiency that the severity of the Indianapolis collision was due. The rule directed him to look out for "any train that may be inside the yard limits." If it had said "any train that may be inside the yard limits moving towards you at . . . miles an hour," it would have, at least, stated the possible conditions and by so much have stimulated his watchfulness and caution. As we remarked in discussing the Indianapolis disaster, this requirement, on a single track road, is difficult to define and to meet; and the reissue of the rule at this time, embracing this and the other weaknesses mentioned, has therefore seemed to call for this notice.

Automatic Signals in Severe Cold Weather.

During the early part of January the *Railroad Gazette* asked information from the important railroads which are large users of automatic block signals, and which operate in regions where the thermometer was ranging from zero to many degrees below, as to what failures of automatic block signals occurred in consequence of the severe cold weather, and how they failed. Nearly all of them replied and most of them showed an interest in developing the whole truth, so that both the railroads and the manufacturers may be warned by knowing any weaknesses and be spurred to correct them. The sum of the information given is that automatic signals have generally worked well through a test of unprecedented severity and length of time. As one general manager expresses it in his letter: "I do not think there is the least reason for you to take a back seat in the matter of automatic signals. Under the stress of severe weather more engines fail, more brakes fail, and especially train heating fails. I do not consider, because we had more freezing of drip pipes on steam heated trains than last year during the same period, that it reflected on steam heating of trains as a whole. Nor would I feel like recommending the disuse of certain classes of our locomotives because we had more leaky flues and fire-boxes during the cold weather than on the average. I feel that automatic signals are here to stay and that we must simply go ahead and make such repairs as may be necessary to keep them up in such condition as to obviate failures, just the same as we do with other appliances."

Just half of the officers making reply inhibit an identification of the company's name, and several, in giving detailed facts, do not permit the publication of all of them, and, therefore, it seems best, in making extracts from the reports received, to omit all company names. That which directly relates to the subject and which we are allowed to publish is given in the following quotations from the letters received:

"We have had no failures of automatic signals on account of the recent cold weather."

"Our trouble with signals was on account of wires snapping, due to extreme cold weather. We had very little trouble on account frozen signals. There was no substitution necessary in our case. The signals going to danger, simply brought the trains to a standstill, and they proceeded into block under the rules, looking out for obstructions ahead. Our repairmen very quickly remedied the trouble, and we had practically no interference worth mentioning on account of this cause."

"While we have had a few additional failures, I do not think that the increase would warrant any condemnation of the automatic signals in any way. There have been a few cases where frost on relays has prevented their operation, but the failures that have occurred on our lines have almost entirely been due to poor inspection or poor workmanship."

"We have had no particular trouble with our automatic block signals during the cold weather of the past six weeks, which has been very severe and continuous. I have no objections to your referring to the fact that

such is the case in regard to working of automatic block signals on the . . . . . Railroad."

"Last fall we placed a large number of our battery jars in wells placed in the ground to prevent freezing, and where this was done we have had no trouble whatever with our signals. We had a few instances on the mountain where difficulty was experienced with our signals where the jars had not been placed in wells in the ground, which occurred during the recent severe cold weather."

"There have been instances where electric semaphore signals have failed on account of batteries freezing. There has been but one failure of signals in the danger position, and one in the clear position, due to ice forming on the points of track relays. These relays are located inside the bases of the signal posts and moisture condenses inside the relays. It appears that this trouble has occurred only when the ventilating openings in the bases are small. These small openings were used on the signals first built, but larger openings have been used recently and there has been no trouble with them."

"We have had considerable trouble from frozen batteries, the cold being so severe that it froze the bottom cells in the 8-ft. wooden battery chutes in quite a number of cases. The frost has gone into the ground so far that although it has been thawing out-of-doors the last few days, it has been necessary to keep lamps in the elevators to keep the batteries working. A . . . signal was frozen in the clear position by snow and sleet. As the signals were, of course, being watched very closely, it was discovered at once."

"The electric motor signals on the . . . divisions were out of service for a short while, due to batteries freezing. These batteries had been placed in the base of the signals in accordance with the practice recommended by the signal companies. We have changed this practice and provided battery wells on the ground, which will prevent furture trouble of this character. We had no failures of the electro-gas signals."

"There have been instances where the main air pipe has been broken or pulled apart by extreme contraction, and also freezing of water due to condensation in the main air pipe. Trouble has been experienced where main line air pipes freeze, but where there are compressors on both sides of the points where the freezing occurs, the detentions have been trifling. None of the failures for the above reason have been of long duration, as the necessary repairs were made very promptly after getting repairmen to the line of trouble, and it has not been necessary to issue notice that any signals were out of service for a considerable time, or make any provisions for signaling trains by any fixed means."

"On account of the excessive cold, one of the expansion joints in the pipe pulled apart, which threw all of the signals on the . . . division out of service for two hours until repairs could be made. During this time trains observed the prescribed rule of stopping at each signal and then proceeding with caution."

"In our automatic block signal system we have in service 1,372 disk signals and 32 Hall electro-gas signals. We had, during the week of extreme cold weather early in January, 10 failures as follows: 2 broken track connections caused by signalmen cleaning snow from switches; 4 broken line wires; 1 commutator out of adjustment due to contraction; 1 broken contact point in switch instrument; 1 facing point switch out of adjustment; 1 track connection broken by something dragging. All repairs were quickly made and trains were run under the one-minute rule. There was no general failure or interruption at any particular point."

"This company has in service 671 electric signals, 200 of which are disk, the balance being semaphore signals. The total number of failures for the month of December was 38, or an average of one failure to every 20,000 train movements. We have not had more failures during the cold and freezing weather, owing, I think to the fact that our practice is to put signal batteries about 2 ft. below the surface of the ground in substantial wooden boxes." (This company has not furnished a report for the severe weather during the first part of January.)

"This company has 265 miles double track protected by disk signals. During the month of December there were 13 broken line wires, 4 broken drop wires and 3 frozen batteries. During the first week in January, when the thermometer ranged from zero to 20 below, and the snow-fall, averaging 14 inches, was the heaviest in years, there were 2 frozen batteries, but no broken line or drop wires. There were 17 failures from other causes. The principal cause was frost on relay points, preventing good contacts. This ordinarily corrected itself, when the relay dropped and picked up again, by the brushing of the frost away on account of the sliding contact of the points. Failures were so infrequent that our rules requiring stop and further movement under caution took care of train movements."

December Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of December, printed in another column, contains accounts of 43 collisions, 20 derailments and 2 other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Killed.	Injured.
2d—Greenwood, Del.	2	Many
†10th—New Cumberland Jc., W. Va.	1	15
13th—Piedmont, W. Va.	4	3
*†13th—Albia, Iowa	3	12
18th—Rialto, Tenn.	1	6
†21st—Godfrey, Kan.	10	32
†23d—Laurel Run, Pa.	65	4
†26th—East Paris, Mich.	22	29
29th—Larwill, Ind.	3	5

These nine cases make the most appalling list of the kind that we have published for many years, and the total killed, 111, is swelled to 167 if we include the whole of the two-column record which makes up the month's history—89 passengers and 78 employees. Of injured there are more than 280.

The three prominent cases, Godfrey, Laurel Run and East Paris, have already been reported in the *Railroad Gazette*. We have as yet no report of any authoritative investigation of the Laurel Run disaster, and the character of the cause is such that a considerable study may be necessary to determine what, if any, improvement is needed in the regulations for loading, inspecting and watching merchandise which is carried on open cars. A newspaper in Pennsylvania has published a report, purporting to have been made by the superintendent of the division of the road on which this accident occurred, to the effect that this cause—defective loading of open cars—had been a common annoyance for a long time, and demanded heroic remedies. How true this is on railroads generally we do not know; but we have not noticed, in the accident records, any increase in this class. In so far as the rapid increase in the use of large-capacity cars during the past five years has produced new dangers, of which employees have not taken careful note, there is plausible ground for the alleged statement by this superintendent.

Concerning the East Paris collision, as the engineman who ran past a train-order stop-signal was, according to reports, but slightly injured, his version of the trouble ought to be forthcoming. In the Godfrey case it is said that the brakeman who neglected to flag the passenger train is to be tried on a charge of manslaughter. Larwill is an instance of the most insignificant error—wrongly reading a single penciled figure—affecting the safety of one of the best-known "crack trains" of the country.

The number of electric car accidents reported in the newspapers in December was 13, in which 3 persons were killed and 43 were injured.

NEW PUBLICATIONS.

The Metric Fallacy. By F. A. Halsey and S. S. Dale. New York: D. Van Nostrand Co., 1904. Cloth, price $1.

The stand which the author of the first part of this book, Mr. Frederick A. Halsey, has taken before the American Society of Mechanical Engineers and other organizations whose members would be most seriously affected by any change in the standards of weights and measures, is one of unalterable opposition to the adoption in any degree of the metric system. Many of the arguments here presented are reprinted from previously published papers and discussions by the authors and to those who have followed the movement for the general adoption of the system the book will contain little that is new. The testimony presented before the House Committee of the 57th Congress, on Coinage, Weights and Measures is used as a basis for a protracted argument against the proposed change from a tried and almost universal system of measurement to a comparatively new system which is characterized as more of a fad than anything else. To the intelligent and informed student of commercial and manufacturing conditions, the strenuous attack on the new fad would seem to be making a mountain of a mole hill. Any change which may come about will occur in response to an insistent and logical demand on the part of the majority and such evolution, for it cannot rightly be called revolution, will come by slow degrees and not with one great upheaval from which industry will be paralyzed for years to come. Legislation cannot make such a change, at least not in this country, nor can a few faddists comprising a small clique, control the actions of the great mass of the people who will adopt or retain the system which best suits their individual and collective needs. The latter part of the book, which is written by Mr. Dale, is devoted to a discussion of the units of measure employed in the textile industries in this country and in Europe. The confusion which exists and the almost hopeless entanglements arising from the interchange of different units in commercial transactions are taken as arguments against the adoption of another and unnecessary system based on the meter and the gramme. A rather valuable table is given of the Continental systems of numbering spun yarn, compiled from the latest French, German and Spanish authorities. The list is useful in showing the Continental chaos of textile weights and measures and also for finding the reciprocal equivalents of the numerous systems of yarn counts now in use.

TRADE CATALOGUES.

The Case Mfg. Co., Columbus, Ohio, has recently issued two handsome catalogues describing their output of cranes. Catalogue No. 15 is devoted to electric traveling cranes and describes in some detail all the features of this line of machines which the company makes. The latter part of the catalogue contains a number of pictures of characteristic installations of different types and capacities of electric cranes. The smaller catalogue, No. 14, shows some of the company's numerous types of hand and air-power cranes. These are made in all types, either traveling, gantry, jib or post cranes. This company has recently remodeled its factory and is prepared to furnish cranes of any type for any purpose, with prompt delivery. Copies of the catalogue and the accompanying price list and discount sheet will be sent on request.

The Indianapolis Switch & Frog Company, Springfield, Ohio, issues a 48-page pamphlet, 8½ in. x 12 in., and with flexible cloth covers. It contains illustrations in half-tone and from line drawings, of standard designs of T-rail special frogs for both steam and electric roads. These include different types of steam road crossings, both right-angle and frog, crossings of steam and electric roads, frogs, switches, switchstands, etc. The company also does a large amount of special design work.

Twist Drills; Their Uses and Abuses.—This is the title of a little book recently issued by the Cleveland Twist Drill Co., Cleveland, Ohio, in which the theory and operation of the twist drill as a cutting tool is briefly but clearly explained, and a few hints are given as to the correct method of dressing and grinding drills to obtain the best results.

The Rodger Ballast Car Company, Chicago, has a handsome 1904 calendar showing five views of the Hart convertible car, Class C. S. These views include a side elevation, end elevation, and cross-sections, showing the car arranged for side dump, center dump and as an ordinary gondola. The engravings are in colors.

The Canadian Railway Commission Law.

BY S. J. M'LEAN.*

The recent announcement that Hon. A. G. Blair, Ex-Minister of Railways & Canals, of Canada, had been appointed Chairman of the new Canadian Railway Commission, marks the close of a transitional chapter in the railroad policy of Canada. In the discussion of the problem of railroad regulation Canada has gone through many phases similar to those of the experience of the United States. In the early seventies there were propositions akin to those of the Granger legislation. The railroad consolidations which took place in the early eighties led to propositions for the establishment of a railroad commission modeled on the English Commission. In 1886 and 1887 the whole matter was investigated by a Royal Commission which found that there were grievances with which the machinery provided by the existing railroad law could not deal. At the same time it was considered that conditions were not ripe for the adoption of the commission plan. The English legislation was not considered applicable to Canada because of the difference in conditions. The Interstate Commerce Commission was too recent an experiment. As a compromise, it was suggested that the Railway Committee of the Privy Council should be given cognizance of rate grievances. This suggestion was acted upon in the revision of the Railway Act in 1888. The Railway Committee of the Privy Council was a committee of the Cabinet composed of the Minister of Railways & Canals, and certain other members of the cabinet. This body had been concerned with the general supervison and enforcement of the provisions of the Railway Act. It was now made a tribunal to deal with such railroad rate grievances as might arise.

Since 1897, shortly after the Hon. Mr. Blair was appointed Minister of Railways & Canals, the problem of improved methods of railroad regulation has been under consideration by the Canadian government. During 1901 a special investigation was made which found that there were grievances existing with which the Railway Committee could not satisfactorily deal. The report found that in the Railway Committee it necessarily happened that the Minister of Railways was the only one fitted to deal with technical details. In strictness he has been the railroad committee; and the regulative policy has varied as the interest in and knowledge of matters of railroad regulation on the part of the incumbent of the office for the time being. Then again while so much dependence necessarily rests upon him it seldom happens that in the first instance he possesses technical knowledge of railroad affairs. Even when the knowledge of such affairs is obtained political exigencies may lead to an exchange of or retirement from office. The Royal Commission of 1886 had anticipated that the duality of function of the members of the committee would militate against its success. The committee has also been hampered by its non-migratory character. In 1886 it had been suggested that this might be offset by the appointment of deputies who would make preliminary investigations for the information of the committee. This suggestion, however, had not been acted upon.

The legislation of which the provision for the Railway Commission forms the central portion received very care-

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ful attention. After the legislation had been drafted the railroads were afforded an opportunity to present their views. The legislation was presented *pro forma* in the session of Parliament of 1902. Then it was once more gone over carefully, and the matter was brought to a final vote in the session of Parliament which closed late in 1903. There was a substantial unanimity on the part of both political parties that such a measure was necessary; the criticism was directed to details.

The commission is composed of three members appointed by the cabinet. Each commissioner holds office during good behavior for a period of ten years, but is removable for cause. The chairman of the commission receives $10,000 a year. The other commissioners receive $8,000 each. The act gave internal evidence that the chairman of the commission was to be a lawyer expert in railroad law. The Hon. Mr. Blair, with over twenty years of active law practice and seven years' experience as Minister of Railways & Canals, meets every demand of the law.

To the commission are transferred all the powers formerly possessed by the Railway Committee. The enumeration of some of these powers will serve to show how wide the jurisdiction is. It has power to make regulations limiting the speed of trains in cities and towns; to oversee provisions in regard to safety appliances; to pass upon disputes arising in respect of railroad crossings and junctions; to hear proceedings in connection with disputes arising between farmers and railroads in respect of drainage; and in general to see that the railroads obey the laws, general and special, under which they operate. The commission is thus made the general supervisor of the enforcement of the railroad laws.

It is in respect of the provisions regulating rates that certain novel features appear. In the drafting of the legislation there was held in mind the defects which English and American experience had shown in existing legislative enactments. The Canadian legislation provides that rates are to be reasonable and just. The commission may disallow any tariff which violates this provision. The railroad is to substitute a satisfactory tariff or the commission may itself prescribe one.

The judicial emasculation of the "long and short haul" clause of the Act to Regulate Commerce is well known. Under the "long and short haul" clause of the Canadian legislation it is explicitly provided that it is the commission which is to determine when, on account of competition, an exception is to be permitted. Further, the commission determines what places are competitive points. In regard to discriminations the question whether the commodities have been carried "under substantially similar circumstances and conditions" is a *question of fact* which the commission determines. The legislation contains an anti-pooling clause. This did not appear in the first draft of the legislation as submitted to Parliament; nor did it excite much discussion in Parliament. The Canadian railroad system has developed along the lines of division of territory.

The commission inherits the powers formerly possessed by the Railway Committee over classification and has thus with certain additional powers conferred complete control over the base of rate making. It may prescribe a uniform classification. It may allow exceptions from this when in the public interests. It may cause commodities to be changed from one class to another. In regard to the rates themselves it is intended that rate making should in the first instance be in the hands of the railways; the powers to be exercised by the commission are to be remedial as well as preventive. Where formerly the control was through maxima it is now concerned with the published rates. A sharp distinction is made between non-competitive traffic, in which the rates may be stable over a period of time, and competitive traffic which may require almost instantaneous readjustments of rates. There are to be three classes of freight tariffs, known as standard freight tariff, special freight tariff and competitive tariffs. Non-competitive traffic falls under the standard freight tariff. The special freight tariff is really a commodity or exception tariff concerned with commodities which must be carried on an especially low rate basis. The competitive tariffs cover freight carried on a low competitive rate base. It is to be remembered that these are concerned with traffic between points which the commission has already declared to be competitive. Both the standard and the special freight tariffs are required to be filed with the commission before they can be effective. Public notice is also required. The special freight tariff has the requirements of notice in regard to advances and reductions which the American legislation prescribes on interstate rates. In dealing with competitive rates the procedure is much more elastic than in the American legislation. The commission has a discretionary power in regard to the formalities to be observed in connection with their publication—no express period of notice being specified—and it may allow such tariffs to become operative before they have been filed with the commission. The commission has similar powers of control in regard to passenger rates. The legislation also confers powers in regard to joint rates modeled upon those of the English legislation. The provisions in regard to traffic through, into, and from foreign countries resemble those contained in the American legislation. The idea ever present to combine control with elasticity shows in the fact that, subject to the control of the commission, the railroads have, as before, the power to make special rates between non-competitive points with a view to the development of trade and industry.

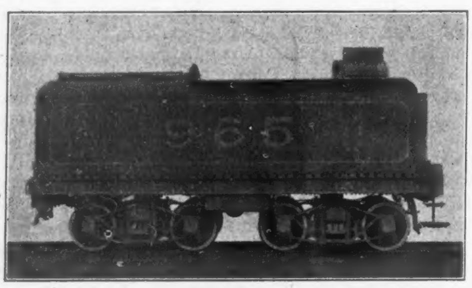
The difficulties which have arisen between the Interstate Commerce Commission and the courts cannot arise in the case of the Canadian commission. The commission has final power in regard to questions of fact. It is only in respect of the legal phase of its work that any relations to the courts arise, and here the relations are with the Supreme Court direct. There may be an appeal from the commission to the Supreme Court on a question of jurisdiction. There may also be an appeal from the commission to the Supreme Court on any point which the former considers a matter of law. On any appeal to the Supreme Court the decision is to be rendered as soon as possible. To bring out the sharp distinction from the American practice a clause, in which I have italicized the important parts, is quoted from the Canadian legislation: "On the hearing of any such appeal the Supreme Court . . . may draw all such inferences as are *not inconsistent with the facts expressly found by the Board* . . . and shall certify their opinion to the *Board, and the Board shall make an order in accordance with such opinion.*"

But while the courts do not control the commission, a power of control rests with the cabinet. The cabinet, of its own discretion, or on application from the parties concerned, may rescind or vary any order, decision, or regulation of the commission. This is a natural outcome of the system of responsible government existing in Canada. When the work of regulation was placed in the hands of a committee of the cabinet the ministers were responsible to Parliament. Now, although the work of regulation has been delegated, the ministry are none the less responsible to Parliament, and if there is responsibility there must also be control.

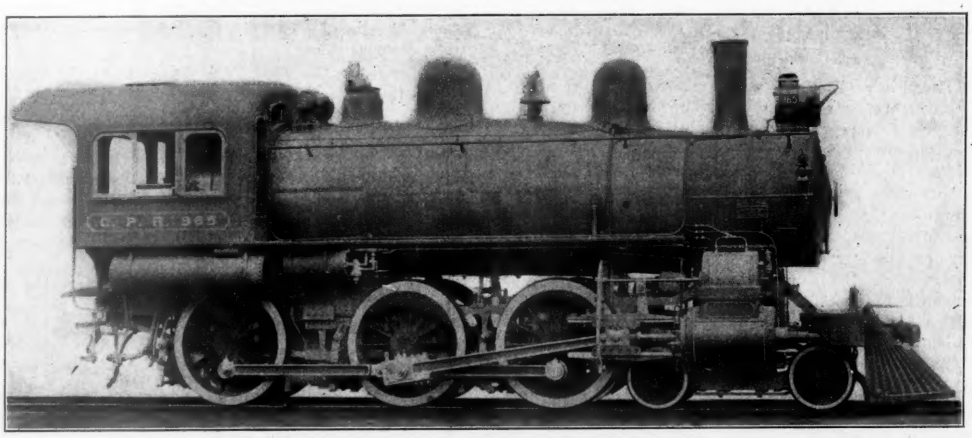
In the discussion which took place in Parliament when the legislation was being passed, the matter was not approached from a standpoint antagonistic to the railroads. It was considered that new regulative machinery was necessary, and it was desired to obtain the most effective type. It was in this connection that some criticism was directed against the government for not offering higher salaries to the commissioners. While much of the work of the commission will be concerned with rate regulation it must of necessity stand for something wider. In the powers which it has with reference to seeing that the railroads obey the laws, general and special, under which they operate it becomes an accessory to the Minister of Railways & Canals in the development of Canadian railroad policy. The railroad regulative policy of Canada has been of slow and regular growth attended by careful discussion and investigation, and there is no danger of the new commission following drastic methods of regulation. The chairman is a man of insight, not illusions. The commission comes at a time when a new trans-continental railroad is being built to meet new national needs, and at the beginning of such an era of expansion the need of a body which will stand for a consecutive policy is apparent. While the government will be responsible for the broad outlines of railroad policy, the commission will be a body whose advice may always be available to the government in dealing with railroad affairs. The legislation explicitly places the commission in a position advisory to the cabinet not only in regard to the financial condition of the railroads, but also in regard to any question which may arise under the general or special railroad legislation of the Dominion. The whole tenor of the movement which has culminated in the new legislation warrants the conclusion that the commission, both as a commission and as regards its individual members, will stand between the parties to the dispute and not as an attorney for the plaintiff; the latter anomalous position has from time to time been present in American regulative experience.

Canadian Pacific Locomotives From Germany.

A considerable description of the consolidation locomotives built for the Canadian Pacific by the Saxon Engine Works, Chemnitz, Germany, was given in the *Railroad Gazette*, Nov. 27, 1903. The accompanying illustrations give a good idea of the general design and appearance of these locomotives. The engines were built to Canadian Pacific specifications and have 22 in. and 33 in. x 26 in. cylinders, 63 in. drivers, and weigh 169,000 lbs., with 128,000 lbs. on the drivers.



Tender of Canadian Pacific Locomotive.



Canadian Pacific German Built Locomotive.

Light Rail Manufacturers' Pool.

The Association of Manufacturers of Light Steel Rails which was formed in Pittsburg on January 15 includes all but one of the smaller independent plants that have a bar mill operated exclusively in making light steel rails, either from billets or by rerolling defective or second-hand standard sections. The half dozen plants that are included in the Association make rails ranging from 8 to 50 lbs. to the yard, the latter being the weight of what are known as light rail sections. There is a probability of other mills of kindred interest being included at the next meeting of the Association in Pittsburg, about the second week in February. These associated manufacturers intend also at that time to fix an absolute price for each mill in the coterie proportionate to the freight rates from the respective mills to the market. At the initial meeting, the prices, different for each mill, were raised temporarily an average of $3.

It has been only within the past few months that some of the plants included in this pool have been making light rails. For instance, a new rail mill at the Atlanta Steel Hoop Co.'s plant was placed in operation late in December, while the Clearfield Steel & Iron Co. has had its rail-making mill running only about three months and the Maryland Rail Co. has been manufacturing light sections about 18 months. This increase of the smaller independent light rail mills has brought about an over-production, and has to some extent demoralized the market until light rail sections, which cost more to manufacture than do standard sections, are selling as low as $25, Pittsburg. These manufacturers saw that unless something was done, some of the mills would have to close operations. While the light rail market had been unusually heavy in the past two years up to last fall, since then there has been a reduction in demand because of some of the coal mines, industrial plants and construction work, which required light sections, closing temporarily. It was because of the heavy demand while business was brisk that more mills were equipped to supply the trade. To counteract the demoralization the new light rail pool desires a fair differential with the standard section mills.

The personnel of the Association and the conditions for manufacturing light rail sections are as follows: Union Rail Co., Huntington, W. Va., which purchased the plant of the Huntington Tin & Planished Plate Co., substituted an 18-in. bar mill for the sheet mill and now manufactures sections ranging from 16 to 50 lbs.: Atlanta Steel Hoop Co., whose new rail mill makes 12 to 40 lb. sections; Cambridge Rolling Mill Co., Cambridge, O., whose bar mill for 8 to 25 lb. sections has been operated for some time; Maryland Rail Co., which purchased the plant of the American Tin Plate Co., at Cumberland, Md., substituted a bar mill for the sheet mill and has been rolling 12 to 35 lb. sections; Fairmont Steel Co., Fairmont, W. Va., which rolls 16 to 40 lb. sections, and Clearfield Steel & Iron Co., Clearfield, Pa., which makes 16 to 40 lb. sections. It was incorrectly reported that the Buffalo Steel Co., Tonawanda, N. Y., was included; this plant has been out of the light rail market about nine months. All of the associated plants have bar mills that are now operated exclusively for rolling light rail sections, and for this billets are used when prices will allow; cast-off and second-hand standard sections

are rerolled when the market price of raw steel is too high.

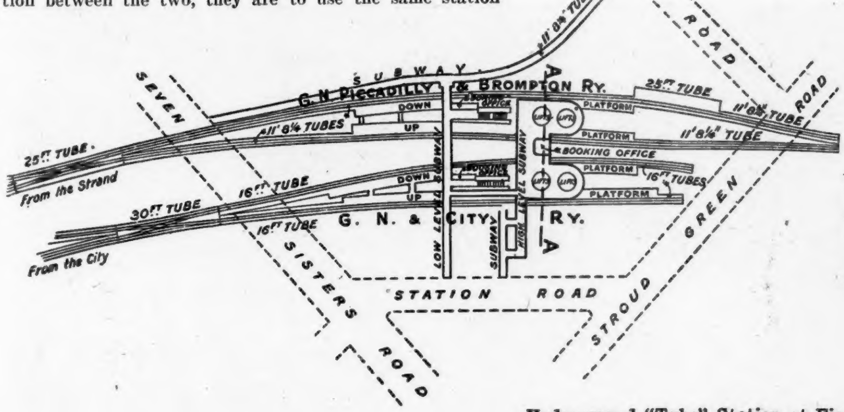
A. F. Baumgarten, President of the Union Rail Co., was elected President of the Association, and C. W. Jewkes, Manager of Sales and Purchasing Agent for the Clearfield Steel & Iron Co., was chosen Secretary. The Association's headquarters are in the Farmers' Bank Building, Pittsburg, Pa.

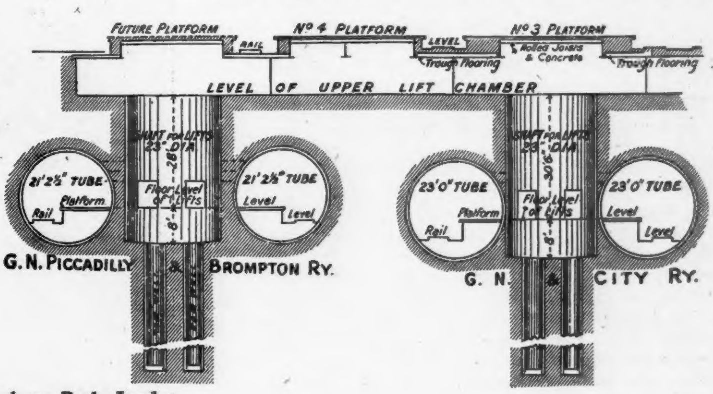
London's New Tube Railroad.

BY C. H. GRINLING.

The Great Northern & City Railway, which is expected to be opened on Feb. 1, is London's fourth electric deep-level railroad (or "tube," as these roads are now familiarly called)—the others being the City & South London, opened in 1890 and since three times extended; the Waterloo & City, opened in 1898, and the Central London, opened in 1900. The City & South London line is seven miles long, the Central London 6¼ miles, and the Waterloo & City, 1½ miles. The length of the Great Northern & City, as now completed, is 3¼ miles, and another quarter of a mile is being added to it at the City end. As will be seen from the accompanying map, the new line runs alongside the City & South London as it approaches the City, and though there is no physical junction between the two, they are to use the same station at Old street, and there is also subway connection at Moorgate street. It will thus be possible for a passenger to travel right across London between the northern and southern suburbs without coming to the surface, the total length of the journey from terminus to terminus being just about ten miles.

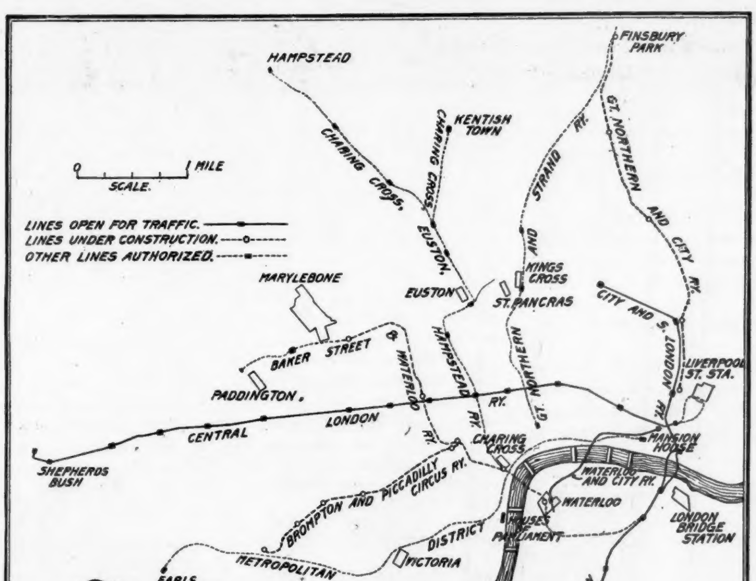
It is by accident and not by design, however, that the Great Northern & City completes this important north and south route. Had such an arrangement been originally planned, the diameter of its tunnels would probably have been made nearly, if not quite, the same as those of the City & South London, whereas, as a matter of fact, there is more difference between them than between the diameters of any other of London's tubes completed or under construction. The diameter of the City & South London (track tunnels) is 10 ft. 6 in.; of the Central London, 11 ft. 6 in.; of the lines now being constructed by the Yerkes syndicate, 11 ft. 8 in.; of the Waterloo & City, 12 ft. 1 in., and of the Great Northern & City, 16 ft. The reason that the exceptionally large diameter was chosen for the line now about to be opened is that it was originally intended to have a physical junction with the Great Northern Railway at its northern end, and to be worked with the ordinary rolling-stock of that company, hauled by electric locomotives. After the greater part of the tube had been completed, this plan was given up in favor of having a "dead-end" terminus for the electric line under the Finsbury Park station of the steam railroad, this terminus being placed immediately alongside that of one of the Yerkes roads—the Great Northern, Brompton & Piccadilly (called in the accompanying map by its original name of Great Northern & Strand, but given its present title in the plan shown herewith). As regards the subway connections between the Great Northern & City and the City & South London, these also were an afterthought arising out of the northward extension of the latter line. Originally there was a gap of over a quarter of a mile between the City termini of the two lines, but subsequent extensions have resulted in their running parallel to one another for about a mile. A further extension of the South London line to King's Cross, St. Pancras and Euston stations (see map) has since been authorized.





Underground "Tube" Station at Finsbury Park, London.

That the Great Northern & City should have undergone these changes is not surprising, when it is considered that the scheme was set on foot by the late Mr. J. H. Greathead as long ago as 1891 and authorized by Parliament in the following year. It was expected that the Great Northern Railway would carry out the scheme in the same way that the London & South Western carried out the Waterloo & City; but the Great Northern was already in alliance with both the Metropolitan and the North London for forwarding its traffic into the City. The result was that the "tube" has emerged from protracted negotiations as an entirely independent undertaking, save that it rents its terminus at Finsbury Park from the Great Northern. But, saddled as it is with the cost of 16-ft. tunnels, it is difficult to see how it can possibly pay its way as a separate company, its capitalization per mile being considerably more than the Central London's, while its traffic field is not nearly so rich. The investing public has, indeed, never favored the undertaking, and the greater part of the financial burden is understood to rest upon the shoulders of the contractors, Messrs. S. Pearson & Son, Ltd., who have also contracted to work the line for three years after its opening, paying the other shareholders a guarantee dividend of 4 per cent. for that period. Messrs. Pearson have also been paying a guaranteed dividend of 3 per cent. on the company's capital during construction.



Map of London "Tube" Railroads.

As already stated, it was originally intended to work the line with electric locomotives, which were to haul the suburban passenger cars of the Great Northern through the tube. When the idea of a physical junction between the two roads was abandoned, the Great Northern & City decided to adopt the multiple-unit system of traction. They were strengthened in this resolve by the experience of the Central London in the matter of vibration. Since multiple-unit trains of the General Electric type were substituted for locomotives on the Central London, there have been no complaints of vibration; but when this trouble was at its height the Great Northern & City authorities were much agitated about it, and Messrs. Pearson devised a new system of construction to meet the difficulty, namely, the substitution of a brick invert for iron plates in the lower half of the tubes. This additional precaution, however, has been considered unnecessary in the last-completed section of the work.

The electrical contractors were the same as for the Central London, namely, the British Thomson-Houston Company, and the train-control apparatus employed is that which is associated with their name in England and with the General Electric Company in America. The Great Northern & City differs from the Central London and the City & South London in having its power-house about midway between its termini, instead of at the suburban end of the line, a most suitable site having been secured on the banks of the Regent's Canal. This advantage, and the short length of the line, make it possible to feed the current direct to the collector rails from a single generating station and yet to use a convenient section of collector rail. Feeding at any other points is not required, and the cost and maintenance of sub-stations is thus eliminated. The power-house also provides for working such of the station lifts as are electric (some of them are hydraulic), and for lighting the stations and tunnels as well as the cars. The lighting of the tunnels is switched on and off from the stations, and is independent of the traction current. The power is conveyed to the motors on the cars by means of two insulated rails per track, one placed inside of each track rail. The rails are of channel section weighing 80 lbs. per yard and rolled to about 42-ft. lengths. The system of collector rails is divided up into four sections, fed independently from the generating station, and the rails of the up and down tracks are interconnected through circuit breakers at different points to equalize the currents in the two pairs of rails.

It is intended to run a three-minute service of seven-car trains (four trailer and three motor-cars) in the busy hours when the suburban rush is on, with a four-car service at three or five minute intervals during the rest of the day. The Central London runs a seven-car service throughout the day. A novel feature of the cars is that they have center-doors at the sides as well as end-doors. These central doors are intended to be used only for the discharge of passengers at the termini, where they will be manipulated by platform porters, the end-doors being worked by the train-men in the ordinary way. It is expected that each train on the Great Northern & City will complete the double journey of 6½ miles, including three intermediate stops, in 30 minutes. Eventually, when all the work is complete, the line will be a quarter-mile longer, and there will be five intermediate stops; but to compete effectively with the rival route of the North London, it will be desirable not to let the time taken in the single journey exceed 15 minutes. No doubt, however, a higher rate of acceleration could be given, if required; it is mainly a question of expense in operation. Probably, the seating capacity of the trains will be severely taxed when the suburban rush is on, and it is questionable whether the cars, as at present designed, will prove satisfactory, as they only seat about 50 passengers each. In tubes 16 ft. in diameter it ought to be possible to give more seats than this per car, while providing amply for the motor machinery, corridors and exits.

As the first tube line to be opened since the Central London was completed 3½ years ago, the Great Northern & City will be watched with close interest; but on account of the numerous changes which its plans have undergone since their inception, the undertaking is of the nature of the "hotchpotch," and, as has been already stated, a success similar to that of the "Twopenny Tube" is hardly to be hoped for.

For the plan of Finsbury Park station and approaches, we are indebted to the *Railway News* (London).

Herr Lavé, the chief of the main railroad station in Cologne, has held that position for 41 years and is now past 70. He has a small museum of orders given him by various crowned heads, and among them the French cross of the legion of honor, given him for his care of the French wounded prisoners which it was his duty to forward during the Franco-German war.